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AN ANALYSIS OF ACCESSIBILITY IN LEARNING MANAGEMENT SYSTEM IN THE CONTEXT OF HIGHER EDUCATION INSTITUTION

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Master Thesis

Supervisor

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AN ANALYSIS OF ACCESSIBILITY IN LEARNING MANAGEMENT SYSTEM IN THE CONTEXT OF HIGHER EDUCATION INSTITUTION

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I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Layth Hani Mahdi Al-Samarai

DEDICATION

To my beloved family (My dad, mom, brothers, sister and my wife), to my teachers in the past, present and future. To my Prof. Dr. Osman Nuri UCAN, to my friends and to all those who truly believed in me and never let me down throughout the way.

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ABSTRACT

AN ANALYSIS OF ACCESSIBILITY IN LEARNING MANAGEMENT SYSTEM IN THE CONTEXT OF HIGHER EDUCATION INSTITUTION

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The main outcomes of the research to define new stander as guidelines for disability usage for LMS in higher and further education institutions, this results enable website designer and programmer to support system disability by enhance the system and analysis it for student to develop improved system that enable disability student to use eLearning CMS, Our main objective to design methodology or stander to indicate if accessible LMC is support disability users to facilitates full interaction by all users

in this research first, we will explore main disability function that include in current online eLearning LMS in higher for two main famous eLearning system as Chamilo and Moodle. It also questions the legal and moral.

Keywords: Moodle, eLearning, Accessibility, Chamilo.

TABLES OF CONTENTS

Pages

LIST OF TABLES

Pages

LIST OF FIGURES

Pages

LIST OF ABBREVIATIONS

Moodle : Modular Object-Oriented Dynamic Learning Environment

HTML : Hyper Text Markup Language

VLS : Virtual Learning System

VLE : Virtual Learning Environment

CMS : Course Management System

OLP : Online Learning platforms

WCAG : Web Content Accessibility Guidelines

LMS : Learning Management System

TTS : Text To Speech

1. INTRODUCTION

1.1 PURPOSE

In last 10 years, the Virtual Learning Environment (VLE) has become very important topics because it's included many features of electronic service for education, [1] time-saving, collaborative learning, learning practice and use of media are the most significant factors influencing the VLE system, and within developing for information technology most of universities focus on delivery the educational contents as online activities and electronic courses, regardless of disability tested or support, [2] critical e-learning acceptance and success measures.

For the content that publish on eLearning system have such standers and important issue such as delivery, functionality, sustainability and usability. Most researches can be found for examine the functionality of eLearning systems, with usability of content in eLearning, our research will focus on disabled users to define modules to use as Standards for support accessibility for design related to html tags for text, images and video, universities need to apply accessibility in their eLearning system in Higher Education, e-learning system usability and identifying continuing accessibility needs.

The role of LMS in university is to ensure the student can be trained with the relevant knowledge, skills, and behaviors, with an aim to efficiently enable the student to complete studied tasks [3]. In this research first, we will explore main disability function that include in current online eLearning LMS in higher for two main famous eLearning system as Chamilo and Moodle. It also questions the legal and moral.

1.2 MOTIVATION

This proposal of this research as continues personal research as I have professional practice in eLearning system and to support disability, [4] this will create additional learning environments in which the effectiveness of different learning methods can be measured, in general and in electronic learning as special case, particularly within the area of end-user systems accessibility.

Related to [5] show that the statistical results as we have as 15% of the world's population they have disability, if we assume that the word population are One billion people.

Most of Higher Education used Learning Management System (LMS) to publish online content for courses, [6] Having the flows preprocessed and aggregated, the two machine learning techniques that will come into play, it's important for it to improve user accessibility of accessible systems by improve simple design and tools for adult learners who are disabled, [7] new understanding of the factors that hinder users from using the LMS, and to improve their learning process and to use technology to help them in education process not to define difficulties, for that this research will focus the main issue should this organization to consider and apply.

1.3 THE CHALLENGE

Many challenges we have for this topic related to the LMS that use on higher education thus we will focus on our example to main LMS Moodle and Chamilo to focus on main issue that should implement and use to solve this research problem, and we will use altinbas university as case study for higher education organization to solve the challenge of Varity type of higher education around the word later we will describe how to apply for each type of institution depending on our case.

1.4 RESEARCH METHODOLOGY

It is envisaged our research will include set of questions to analysis the selected domain, while our methods and modules use set of reference standers and methodology.

Some important methodology point will use on our research to define and analysis of system support of Accessibility In E-Learning Systems for universities related of the fields of Information Services as follows:

Levels of functionality for system to use by Braille readers, screen reader's technology for accessing e-learning systems.
Using of the system by disabled students to be accessing LMS, such as system features, e-learning website user interface, and courses resource.
Standers and methodology for system developers to implementation and providing accessible for online content.
User training for technology developments and accessibility features.

1.5 RESEARCH GOALS AND OBJECTIVES

Most universities can't determine which standers or features should be include or used with implementing or developing the LMS in institution to help disabled students to access e-LMS systems that are educationally valuable to support training for disabled learners.

At baseline, our research will study and analysis the current Learning Management System and Virtual Learning Environments related to levels of accessibility in difficulties faced by the disabled users they use the system and accessing system features, our module will also analysis the interactive content, textual resources, navigation features and communication tools, for the test our research with learners, we will apply the results to two to four university sites that will be selected, after this questionnaires or interviews with student to collect feedback to determine the level of system usability.

1.6 SOFTWARE DEVELOPMENT PROCESSES AND METHODOLOGIES

For statistical we used SPSS packages, to examine any questioner and result analysis. For system development and implementation Macromedia dream waver use as IDE for php language.

As far we will use questionnaires to assess students' usability and satisfy of using the eLearning system, the system module include Student needs according to the level of disability, and the system support of type of disability considered when selecting the selected site for our study basic demographic factors that include age, gender, sex, country will be considered.

1.7 PLANE

In next section, we determine research question by study Literature Review, then Analysis Phase that define main issue to include in our research, section three analysis our prototype and develop system to apply from analysis phase, last section describe the deploy phase that include feedback and add to system to publish (Fig. 1.1).

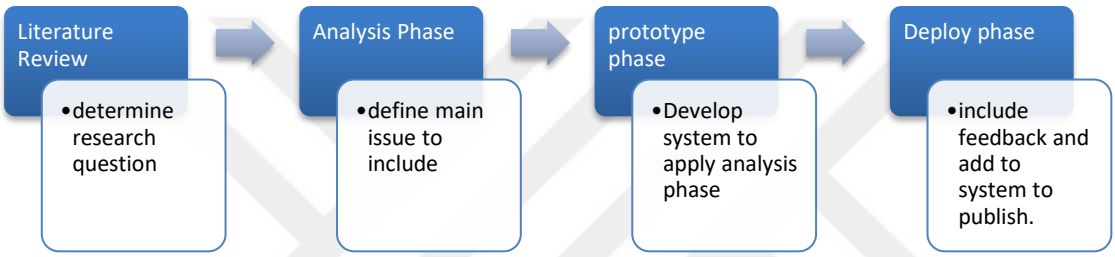

Figure 1.1: Research Plan and Schedule

2 LITERATURE REVIEW

2.1 LITERATURE REVIEW

This section will introduce main obstacle and opportunities faced by disability students when using LMS, determine the main issues in LMS based on usability, after developing the system do we need training for disability users, for web developments standers related to disability users access include set of usability issues be practically resolved to implications of industry-standard developments.

2.2 BACKGROUND

In e-learning, Dr.Achsler [8] referenced the fundamental explanations behind eLearning to rating data is incredibly meager are an absence of inspiration for students to rate, an absence of scoring instruments, and the booked yet restricted learning time of students, E-learning recommender frameworks expect to prescribe a succession of things to students, that is, to propose the most proficient or compelling ways through a plenty of learning assets to accomplish a specific capability. Martins et al. [9] referenced that the client model ought to be helpful for making the instructive procedure progressively versatile and fit for getting ready students for future callings, understudy can be concentrating completely on the web as well as a mix adapting part on learning on the web other face to face learning, as blended of on the web and face the board frameworks.

In [10] shows that the virtual learning systems in this article, have been adopted and are becoming increasingly popular among academics. A virtual learning system (VLS) has a suite of tools with associated functions and non-functional system characteristics, demonstrates that the constructs of perceived importance, generally linked to technology usage can be used to measure educators' beliefs on software quality characteristics. The perceived usefulness and perceived importance constructs are related to implied user needs and user satisfaction.

A Course Management System (CMS) such as Chamilo or Moodle is a tool use to manage all the information about users and courses to share university coursers recourses, in other cases some organization or universities use a training management system, a CMS to upload all the courses

resources and add teachers and students to the system with each have specific rolls, by allow teacher or administrator to logs and schedule entire course offering.

A learning management system (LMS) is a system that enables run eLearning for students to upload eLearning content for your students to access after logging to LMS using computer or mobile devices will be able to access your eLearning courses at any time anywhere, a LMS improve learning process by keeping track students' progress that make their way through and progress easily, most LMS have portfolio for each student that include record for follow main points:

- Course teacher with students.
- Course with all activity and recourses for specific students.
- student's module they read or upload.
- Student portfolio with time for each recourse.
- course grade with Quiz.

Usage of e-learning and data correspondence innovations in training framework could display an open door for educators to overhaul and to improve the addresses and students' exhibitions. ICT improvement is quick and there is requirement for fuse of ICT in instructing and learning process. Utilizing ICT in class can improve information in the field of elucidation, in the learning procedure, yet in addition for future expert action [11].

A virtual learning system (vls) refers to a class of software known by a variety of names, including CMSs, LMSs, virtual learning environments (VLEs), Online Learning platforms (OLPs) and e-learning systems. Chamilo, ATutor and Moodle are examples of the VLS used[12].

The quality models of the eLearning platforms [13] The analyzed quality models are not validated or testing the models based on their different perspectives and dimensions according to survey. In order to improve the quality models, there is a lack of framework. More indicators or characteristics not identified in the survey can be taken into account for future research directions. The application of quality models in accordance with the e-learning systems was proposed based on the survey. The quality features of the e-learning systems were derived from

the investigated studies. For some studies the satisfaction of learners was dealt with in several Studies Different pedagogical characteristics.

Initially, Martin Dougiamas open source learning platform at Curtin University developed an abbreviation of Modular Object - Orientated Dynamic Classroom environment.

In this research, we will use Moodle to evaluation accessibility for visually impaired users, Moodle is one of the most university in turkey used e-learning platforms [14] approximate of 536 sites total used Moodle, and for this reason the evaluation of its accessibility is a very important task in order to guarantee the right to education.

Differently, disability is online activated. Every person with a hearing impairment may find different internet environments significantly disabled, such as for a wheelchair user, by using the Internet video and audio [14].

Although accessibility and the Internet are a continuous struggle, they can also offer many people with disabilities important opportunities. Access to digital communication technology can help people develop their own knowledge by increasing their sense of independence and self-determination for people with disabilities and allowing them to take advantage of online.

Disability is due to the way in which society is organized and responding to people as a consequence of medical conditions that have been seen as arising. This "medical model of disability" is part of the World Health Organization’s international classification of disabilities, disabilities and handicaps (WHO) [15].

The ' capacity of the learning environment to adjust to the necessities of all learners ' is often used in web design and determined in terms of ' flexibility of the education environment (in relation to presentation, control methods, access modality and support for learners) and the availability of suitable alternate but equivalent content and activities [16].

In e-learning, most content-based (CB) recommender systems [17] provide recommendations depending on matching rules between learners and learning objects (LOs), the importance of improving the adaptability and diversity of re-commander systems have strongly emerged. The fast-changing char- arteritis of the e-learning environment show a higher demand for adaptability and diversity than in other fields and propose an e-learning self-organizing recommendation approach initialized by offering highly matched LOs to students. The learning behavior of the learner causes changes in the learning environment, thereby triggering the self-organization of the new sources. The LO studied by the learner is initialized as an active LO. The neighbors with active LOR in the same LOR are first affected. At first. The criteria to determine their behaviors include their similarity to the active LO and their latent quality within LOP. These neighbors may move according to certain rules under certain conditions. The moving LOs forward the data to their new neighbors in LOR. The advice.

E-learning systems are one of the most widely used learning in virtual spaces. [18] The content data passes through intelligent platforms protected by the private protocol to ensure security. Some methods of e-learning have been implemented but the most positive feedback from e-learning systems is the main topic. introduce a new e-learning system methodology called' Network Learning' and review other e-learning systems aspects. Also, [19] Presents benefits and benefits in educational and fast learning programmer, using these systems. Network Learning can be programmable and flexible with too good results for any system of education.

3. RESEARCH PROBLEM

3.1 RESEARCH PROBLEM TO SOLVE

In other words, it may be expected that the LMS market will be worth about $ 4 billion in 2015 and more than $ 7 billion in 2018. North America is expected to generate the highest proportion of revenue contribution.

Keller (2010) acknowledges that students with disabilities may use and read content from the e-learning website, but they are unable to read content, resources, activities, collaboration and tools for interaction. Because of the challenges of making university material accessible as a result of the advancing technology of digital media in recent years, the Universities will ensure quality learning outcomes by supporting accessibility for disability students.

We focus on evaluating two of the most successful open source learning management systems, Chamilo and Moodle, from different approaches, benefits and problems associated with each system to analyze how disability is activated differently online and its impact on internet learning and teaching and accessibility for the main system feature.

The analytics to improving for accessibility of eLearning site to supporting disabled students in [20]. A comparative analysis of disabled students those without disabilities is presented in a large five-year dataset and a broad variation in comparative admission rates is characterized by the use of direct intervention to improve the retention of students with disabilities in order to stimulate a broader interest in the possible benefits of learning analytics for institutions in trying to secure the benefits of education.

The majority of university education is now under way throughout school and little attention has been paid to the benefits of learning analytics to institutional, educational and content - creative students with disabilities who are unavailable [20].

In [21] Constructs an independent pronunciation recognition and evaluation system based on the Chinese Mandarin learning framework. Improved in the acoustic model aspect and the parametric scoring evaluation is performed and discussed from the point of view of the correlation between the machine score and the expert score.

3.2 MODEL OF DISABILITY MAIN CATEGORIES

First, it's important to know your disability main categories (sensory, physical and cognitive) to understand your user's needs, to solve disability for LMS we use three mode (Fig. 3.1) to analysis our LMS for writing, colors and design for the content and system.

Figure 3.1: LMS Analysis Three Modules

3.3 WRITING CONTENT MODULES

periods in abbreviations for some text need to write in details format to help screen reader to recognize the abbreviation without periods such as read E-D-U will be read as "Edu"), for other format in text need to describe the links When embedding rather than just add it to the user to "hyper link text" For example, it's better to write out, "This link show video about 5 min about how core i9 architecture " and it’s not recommend to write " more details click hear".

using HTML Tags (Fig. 3.2) on content used to title page hierarchical structure such as, heading tags <h1>, <h2>, <h3>...

after describing the main title of page need to describe each paragraph text as a section using html tag and .

To support the accessibility for video and image it’s important to use basic html tags attributes such as <alt> and <title> to describe the image by a screen reader and little to making a description of the video or image for users.

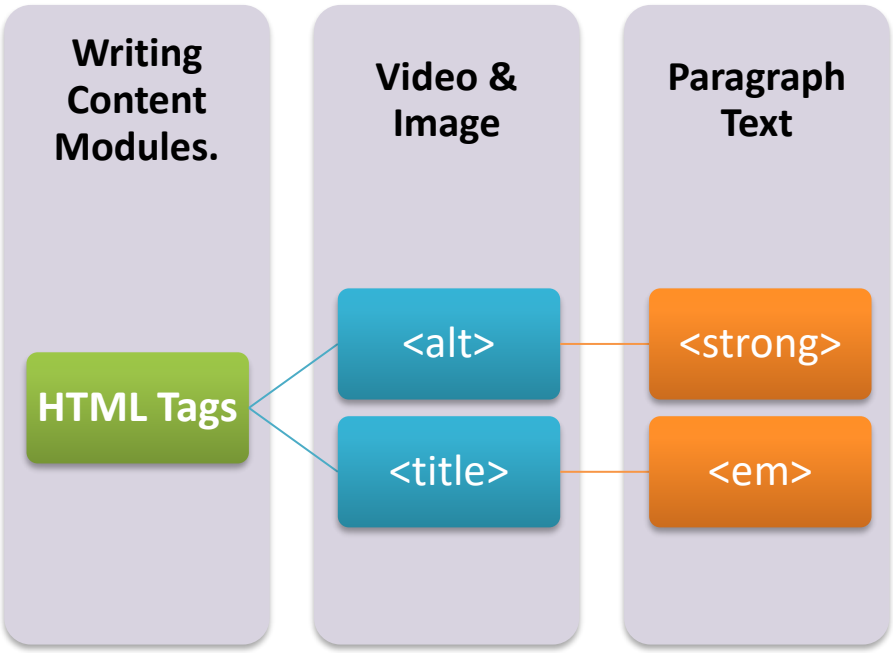

Figure 3.2: Writing Content Modules Main Attribue

3.4 CONTROL COLOURS MODULES

Its stander to use black colors on text with a white background colors as it's the simple and clear practice, and because it's readable for most audiences,[22] is embedding in the value of the color pallet of the font format used in the cells, effective use of color contrast, and gesture navigation for touch-screen devices are some notable aspects of such platforms other issue for the color contrast related to hyperlinked text and regular text that allow users they have color blind to find a link immediately as on not include they will use using cursors to find the links (Fig. 3.3).

Colors can have differing significance in different cultures for that it’s not correct to use color to explain the meaning of content, for that colors should be config by xml language files as multi Language colors.

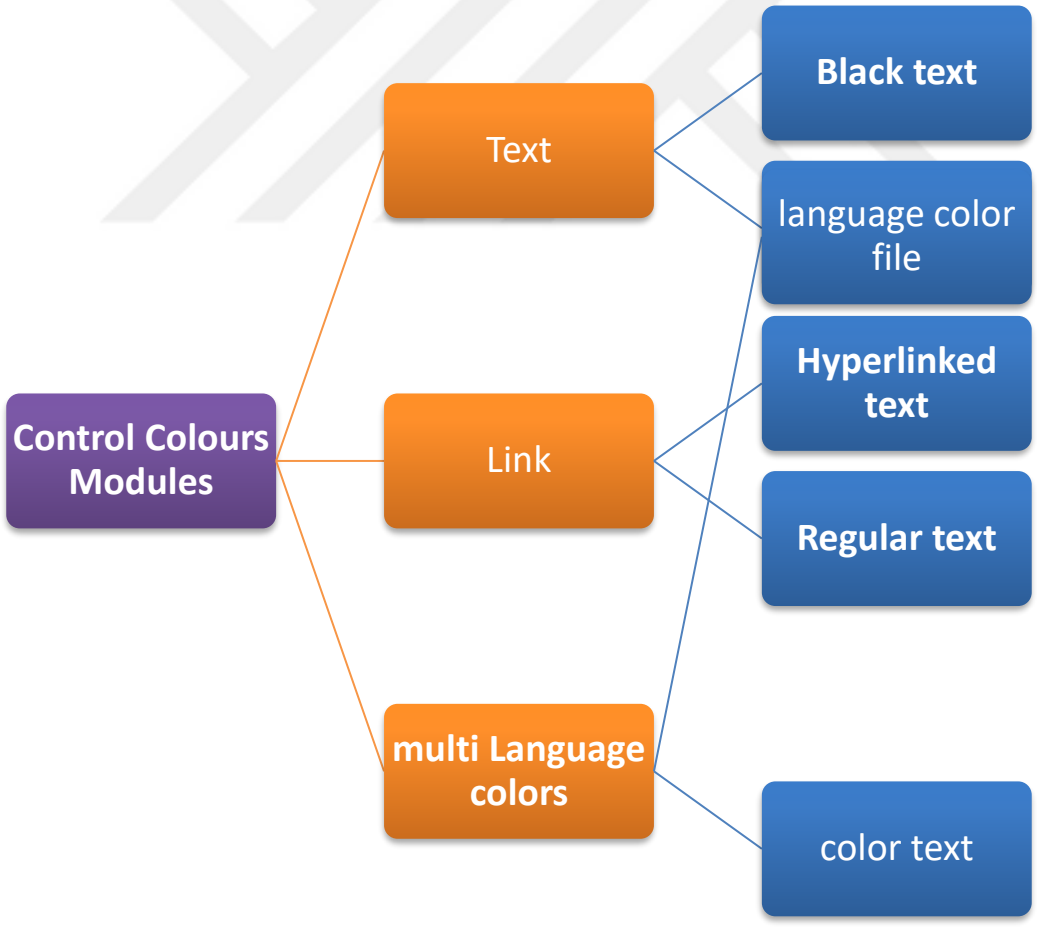

Figure 3.3: Control Colors Modules Main Attribute.

3.5 DESIGN MODULES

This module analysis 4 type (Fig. 3.4) of property, for mobility users with problems, and its essential issue for accessibility users as we have small items and user will click on some of them to know what's the related information about images or video? for that it should to use simple and small paragraphs.

Placing content in dyslexia-accommodating text styles, giving guidance as to successful examination and work propensities, and making a steady and open workplace in online gatherings, discussions and web sheets, to add image in content we should use as a large icon to allow user to click easily, for links Users should be able to navigate using buttons and keyboard, for labels with inputs should support visual presentation. For each page Labels describe attribute should add and unique.

A page title used by screen reader in initial point. unique and describe main idea about page, linked page should be navigable using a keyboard.

Figure 3.4: Design Modules Attribute

3.6 ACCESSIBILITY WITH LMS

To analysis Accessibility for LMS for large set of activity, resources and web interfaces to allow disability user to accessible to an individual eLearning content to meet legal accessibility requirements needs immediately within the learning context. By develop our module will decreases exclusion and increases usability.

For content creator (Fig. 3.5) or teacher its complex job to worry about all issue and criterial to publish the content for disability users, it's not simple we have six criteria should apply as describe in next diagram, for that we will add in our research some of these criteria hidden and other add to teacher to follow it, it's important to identify if LMS use AJAX and JavaScript for Events triggered for this to support accessibility need to support ARIA attributes can assist users of such browsers to follow a dynamic change analyzer.

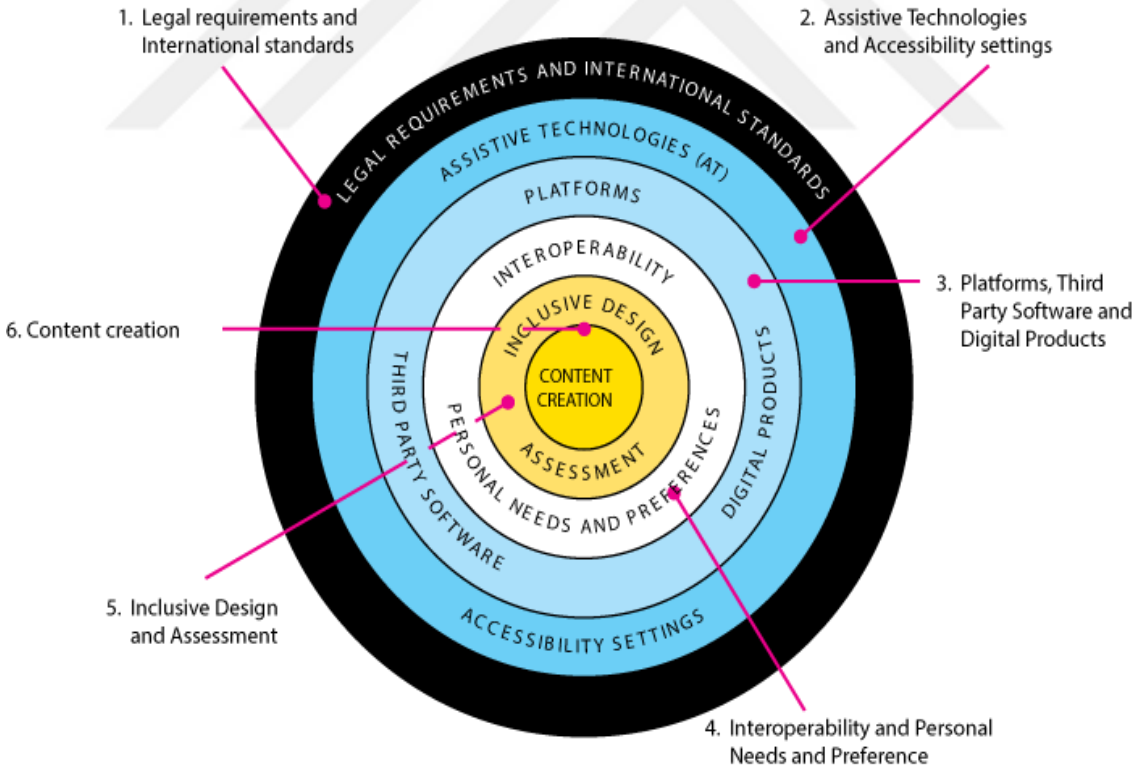

Figure 3.5: Accessibility Specifications [30]

Accessibility solutions help disabled students to receive prompt feedback on the tests they perform, keeping them interested and motivated, such as to help disabled students may over and again listen or watch video, sound or content substance, and take interactive exam that include multimedia as disability students they can listen to audios questions, and can read transcripts.

4. COMPARE CHAMILO WITH MOODLE

4.1 COMPARE CHAMILO WITH MOODLE

Moodle used widely around the word and have more than 100k Registered sites in 229 Countries, [23] An LMS is a web-based software package that is designed to plan, implement and evaluate learning, facilitate student interaction, give performance feedback and manage students' activities. One of the important elements of an LMS is the ability to optimally improve the learning quality and implement an interactive learning system, many universities as primary learning system for education and delivery the course, from statistical charts [24] show below (Fig. 4.1) that united states have about 10 thousand organization used Moodle system and register to mmodle.org, in Turkey they have approximate 600 site register in moodle.org.

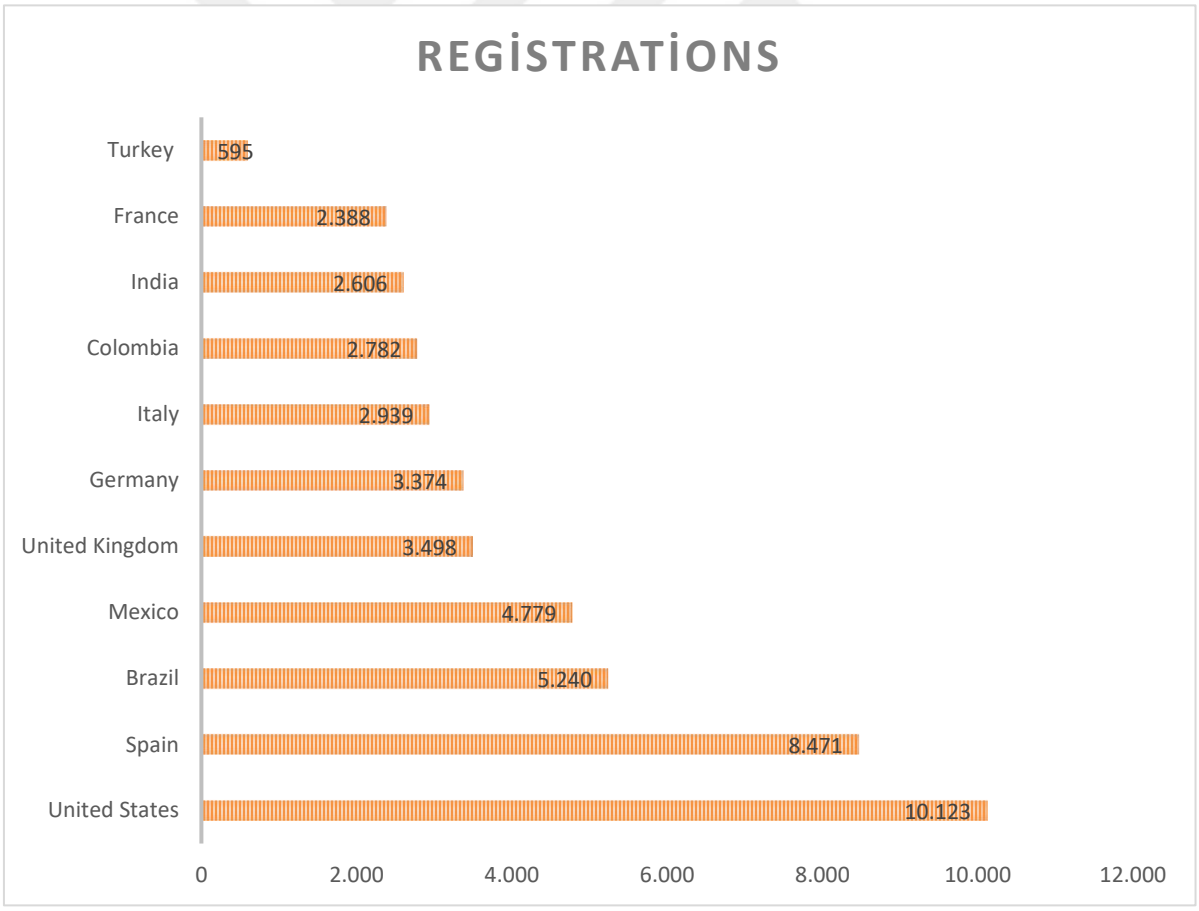

Figure 4.1: Moodle Stat [8].

4.2 COMPARE CHAMILO WITH MOODLE RELATED TO FEATURES

Each learning management system have many features, in (Tab. 4.1) compare two system based on main feature that include most LMS. [25] Moodle is by far the most popular. It has over 84 million users worldwide. Otherwise, Moodle is very easy to import files from Flickr, Google Docs, Dropbox, YouTube, etc. [26] Moodle 6.3. In sum, the issue of earlier systems in e-learning is the missing of some elements of collaboration

Table 4.1: Compare Chamilo with Moodle Features

Highlight	Chamilo	Moodle
Course Overview	include	Support
Calendar	support	install plugins from directory
Declarations	include	Include
Reports and documents	include	install plugins from directory
Tests and Exams	include	Include
SCORM protocol	include	install plugins from directory
Statistics and logs page	include	can’t support
Facebook And Moodle	Include	Can’t Support
Web Links	Include	Include
Message Sheets	Include	Include
Sections	Include	Install Plugins from Directory
Homework’s	Include	Include
Online Learning	Include	Install Plugins from Directory
Email	Include	Can’t Support
Students with Teacher List	Include	Include
Advance Chat List	Include	Include
Appraisals	Include	Install Plugins from Directory

Glossary	Include	Include
Course Logs	Include	Install Plugins from Directory
Record Sharing	Include	Install Plugins from Directory
Surveys	Include	Include
Wiki Pages	Include	Include
Individual Notes	Include	Include
Websites	Include	Include
Content Generation	Include	Include

4.3 COMPARE CHAMILO WITH MOODLE RELATED TO ACTIVITY

system Activity table (Tab. 4.2) Compare Moodle with Chamilo [27] related to system Activity, License, Time Statistics, and Code Analysis.

Table 4.2: Compare Chamilo with Moodle Activity

Project	Moodle	Chamilo LMS
Project Activity	Very High	High
Open Hub Data Quality	Updated 17 days ago	Updated 3 days ago
Estimated Cost	$62,715,465	$32,443,708
Contributors (All Time)	811 developers	144 developers
Commits (All Time)	182,315 commits	45,248 commits
Most Recent Commit	17 days ago,	3 months ago,
Contributors (Past 12 Months)	192 developers	16 developers
Commits (Past 12 Months)	8,924 commits	1,741 commits
Files Modified (Past 12 Months)	10,901 files	55,448 files
Lines Added (Past 12 Months)	1,502,552 lines	1,595,129 lines

Lines Removed (Past 12 Months)	292,981 lines	1,450,689 lines
Year-Over-Year Commits	Stable	Decreasing
Contributors (Past 30 Days)	68 developers	6 developers
Commits (Past 30 Days)	1,565 commits	184 commits
Files Modified (Past 30 Days)	2,719 files	943 files
Lines Added (Past 30 Days)	241,195 lines	29,218 lines
Lines Removed (Past 30 Days)	51,807 lines	67,219 lines
Mostly Written in	PHP	JavaScript
Comments	Average	Average
Lines of Code	3,828,283 lines	2,080,794 lines

(Fig. 4.2) Number of commits who made changes to the Moodle and Chamilo source code each month as shown next, this show that Moodle have more updated and add new feature for the system as the community needs.

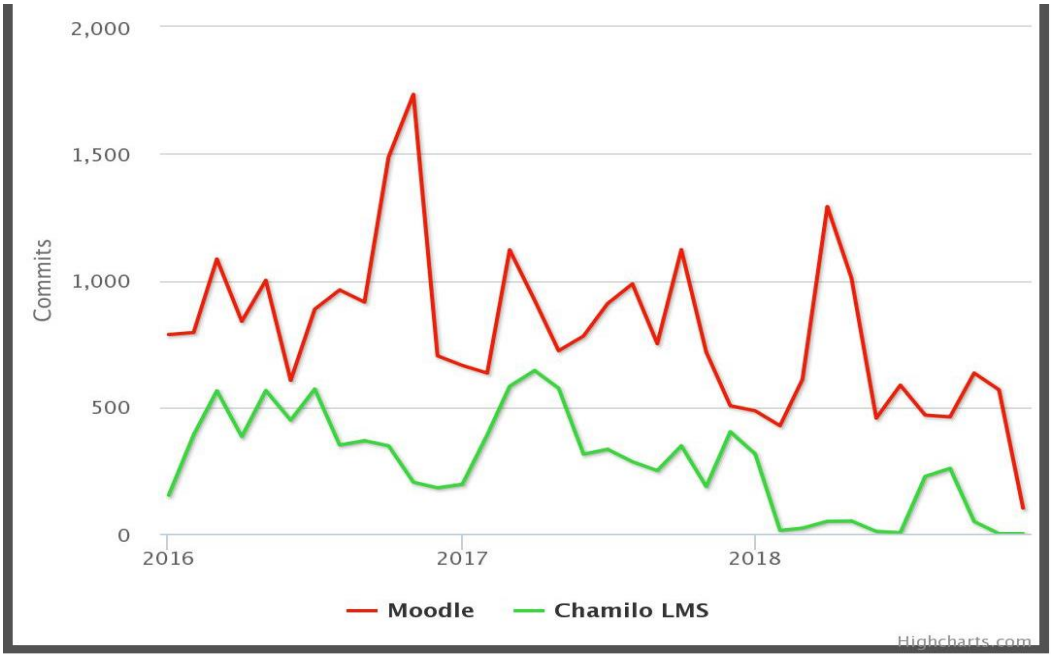

Figure 4.2: Commits Made Changes Over Last 3 Years [16].

From last table show that estimated Cost for Moodle is more than $62M and its double of Chamilo LMS, (Fig. 43) this can give us the result of Moodle more value in most of educational organization based on the Number of contributions who made changes to the project source code each month as show in next diagram.

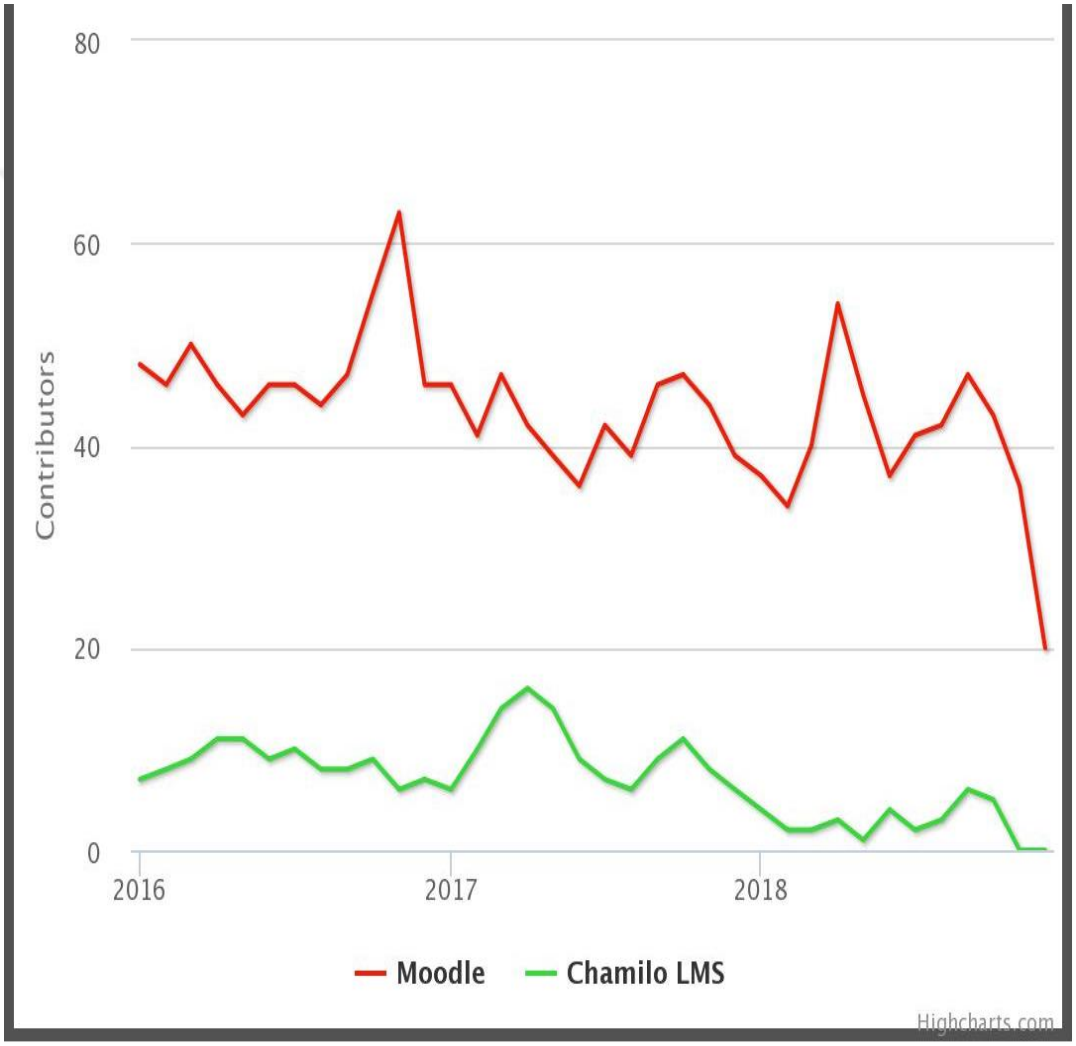

Figure 4.3: - Number of Contributions Monthly [16].

We compare two system related to total lines for source code and results (Fig. 4.4) show that Moodle has about 4 M lines and Chamilo total lines about 2 M lines, this result excluding comments and blank lines.

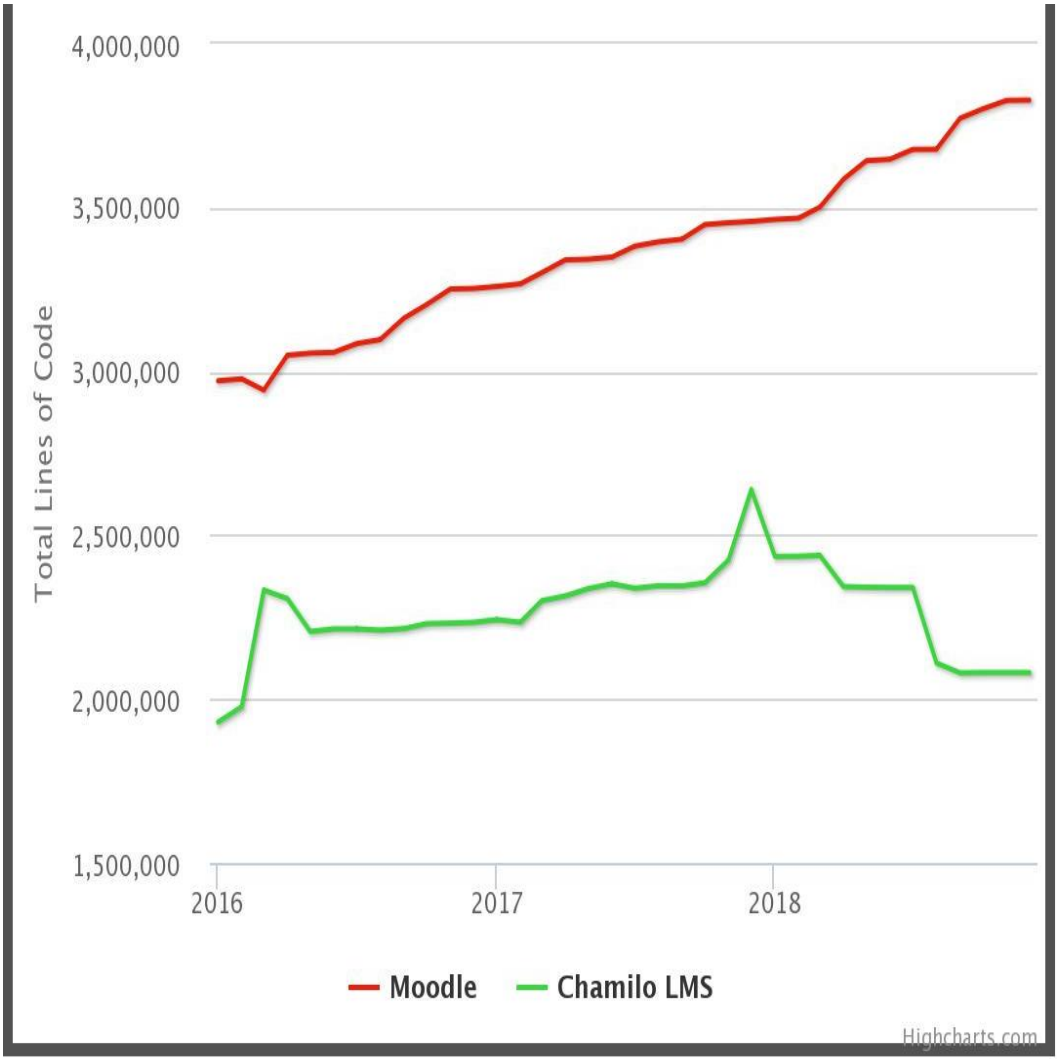

Figure 4.4: Total code Lines excluding comments and blank lines [16].

5. LMS ANALYSIS ACCESSIBILITY MODULE

5.1 INTRODUCTION

This chapter describe the analysis for our proposed module include sub modules and each components of modules with interaction and calling by each other's as package.

5.2 LMS ANALYSIS ACCESSIBILITY MODULE

package diagram includes as shown in (Fig. 5.1) three modules, first need URL after the user add URL to accessibility analyzer will establish with host service to establish the connection and start to call 3 modules to collect results for each sub modules to add and scan based on our roles we provide.

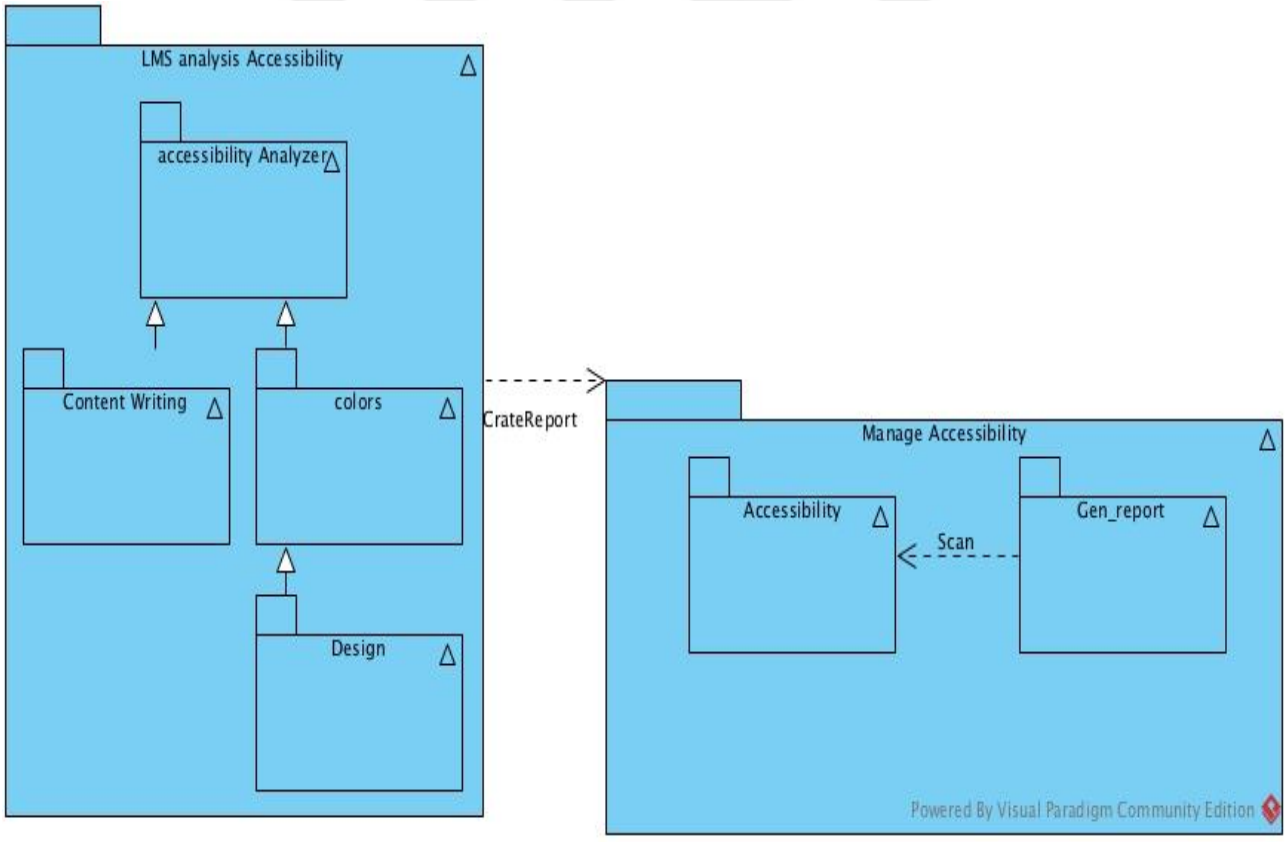

Figure 5.1: Package Diagram

LMS analysis Accessibility diagram (Fig. 5.2) show include 15 elements as listed below, each of modules include attribute and interact with each other as module as describe and show in - LMS analysis accessibility module diagram.

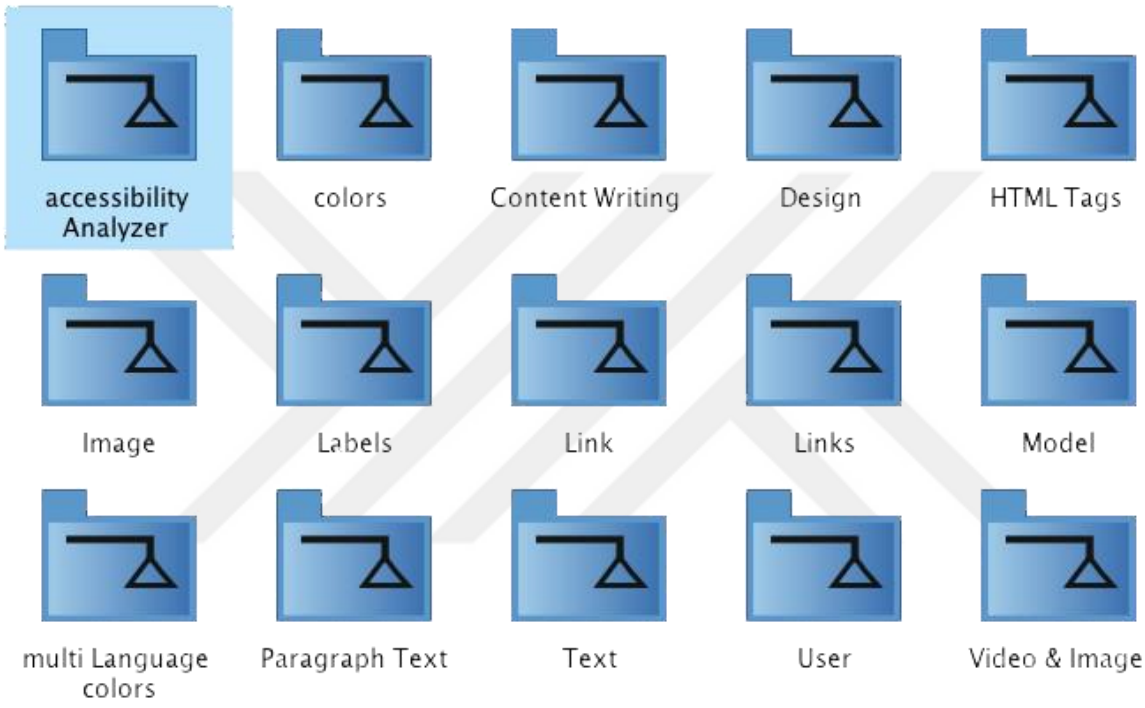

Figure 5.2: LMS Analysis Accessibility Element.

5.3 MAIN MODULE AND SUB MODULES

LMS analysis accessibility module (Fig. 5.3) include three main module and sub modules as shown in next diagram, the main task for this module to generate accessibility report based on URL for LMS.

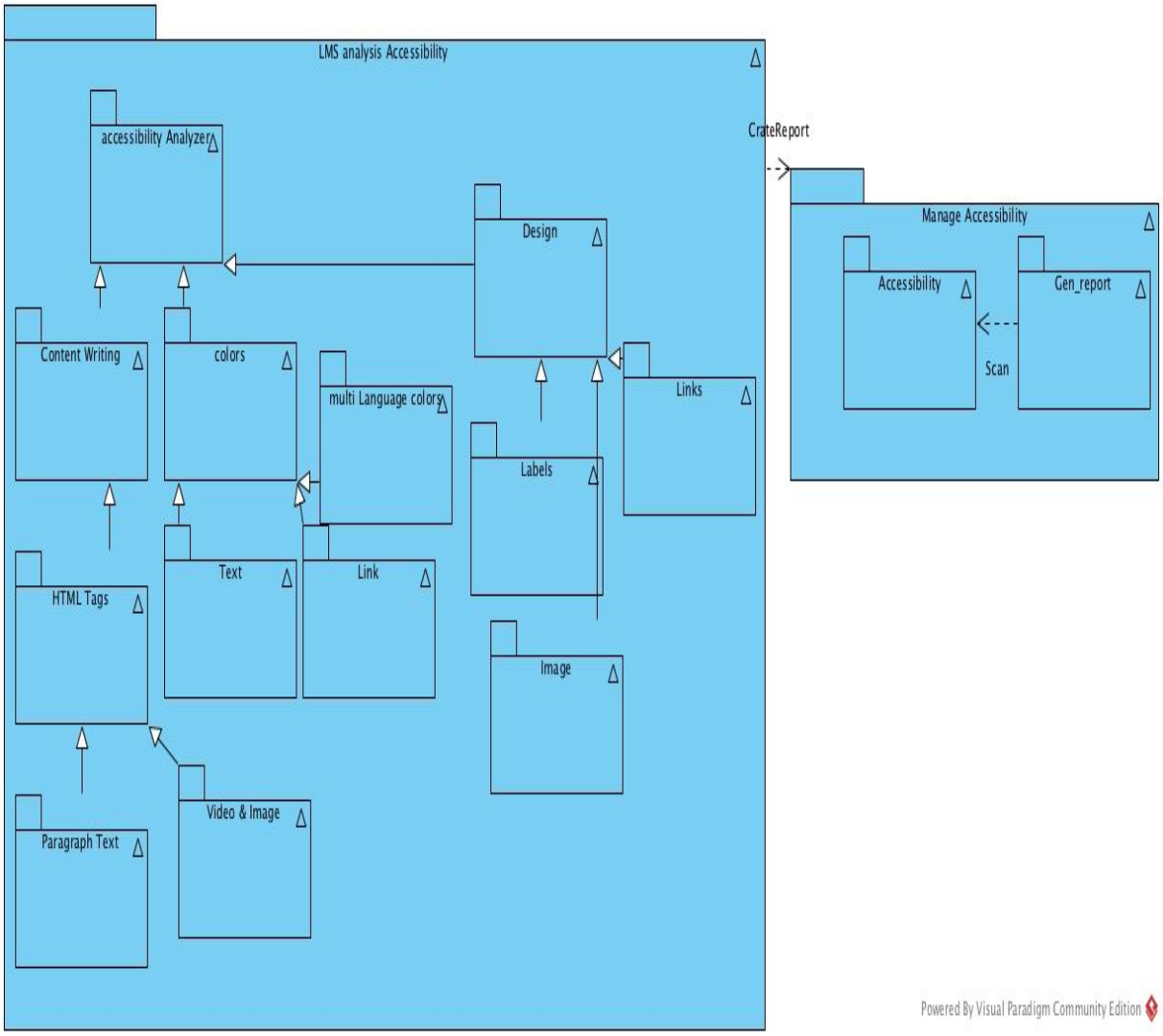

Figure 5.3: LMS Analysis Accessibility Module

User will work with Component by register to system or as free user and store the result to database to store the result to retrieve later and calculate it based on our criterial,

UML Component Diagram (Fig. 5.4) include 9 elements as shown below

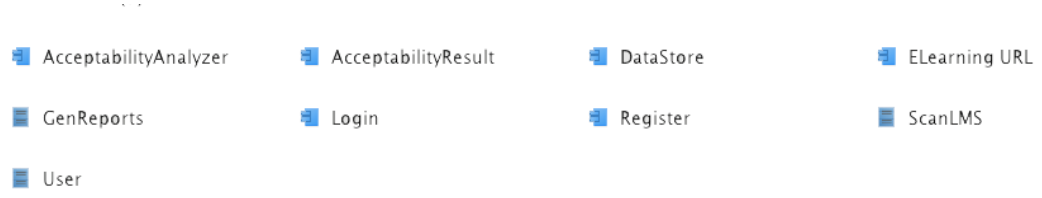

Figure 5.4: Component Diagram.

5.4 UML COMPONENT DIAGRAM

UML Component Diagram (Fig. 5.5) describe main component and how interact with each other.

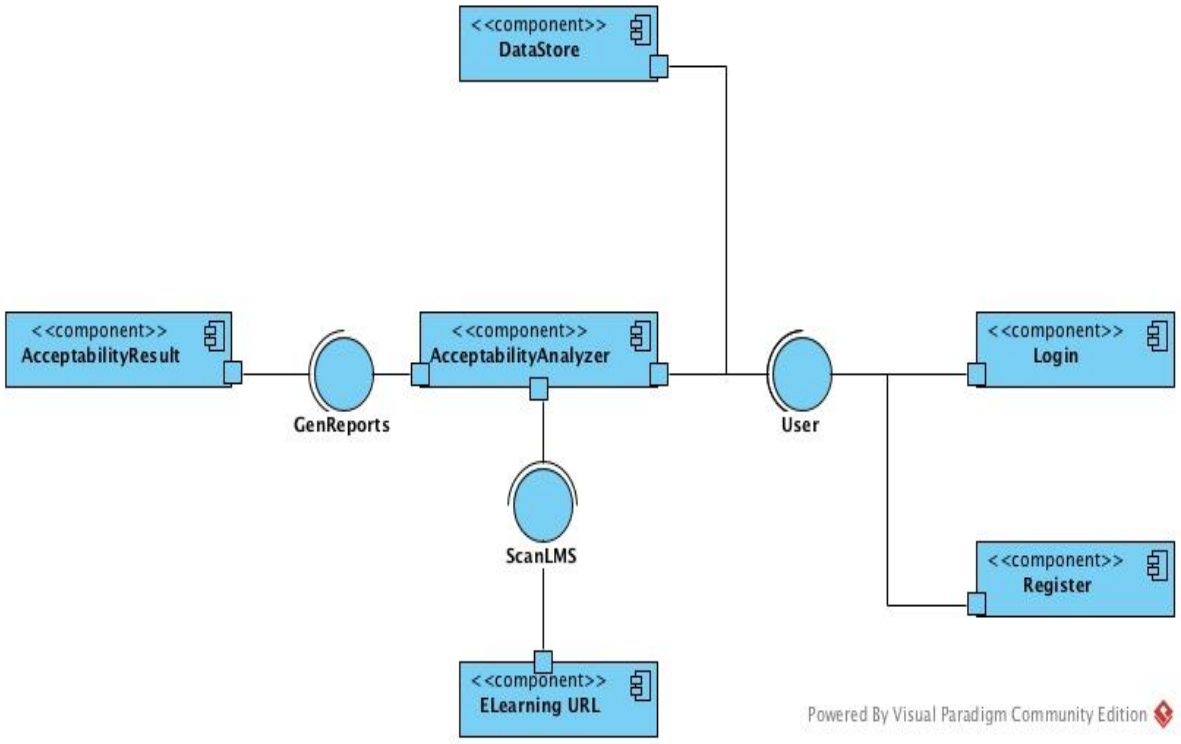

Figure 5.5: UML Component Diagram.

5.5 ACCEPTABILITY LEVEL SEQUENCE DIAGRAM

Sequence diagram (Fig. 5.6) show acceptability level.

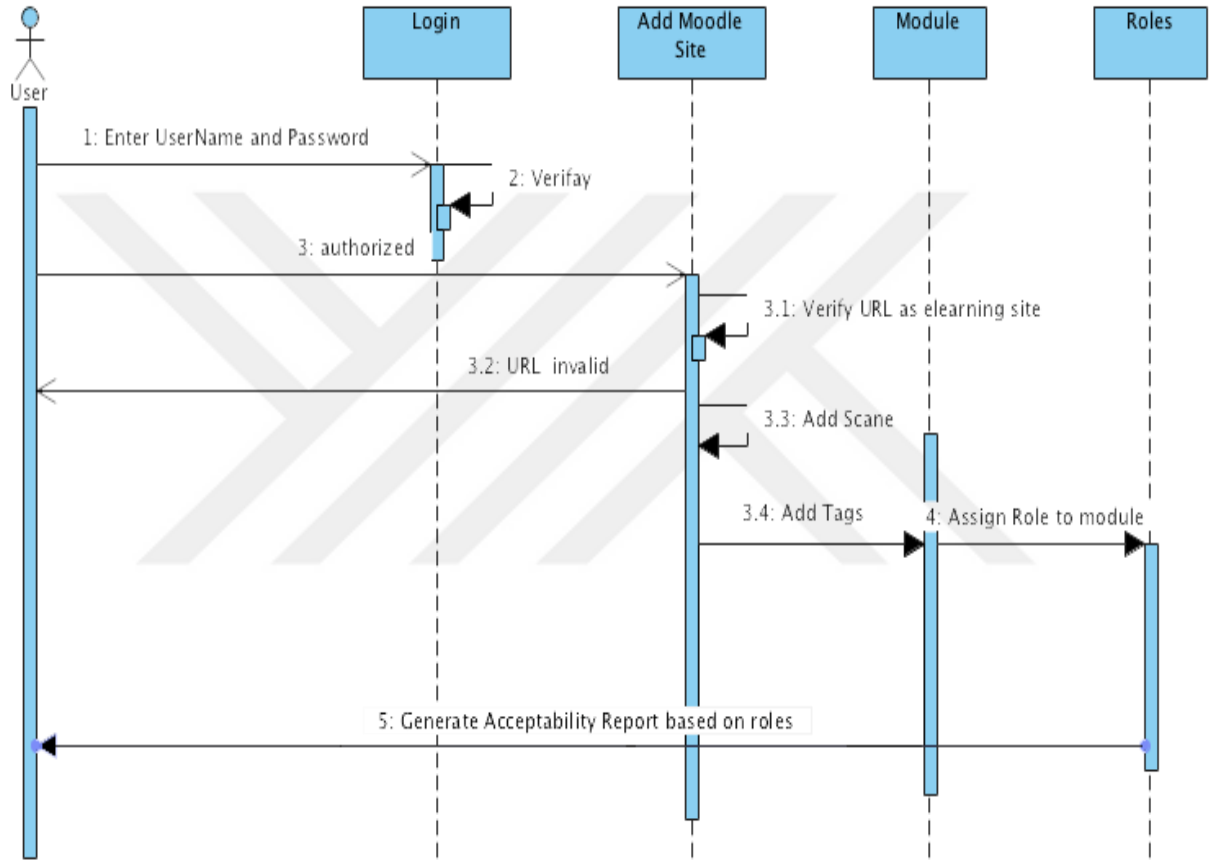

Figure 5.6: Acceptability Level Sequence Diagram

5.6 ACCEPTABILITY CLASS DIAGRAM

(Fig. 5.7) diagram shows the main Class Diagram that our module includes and how interact with each other.

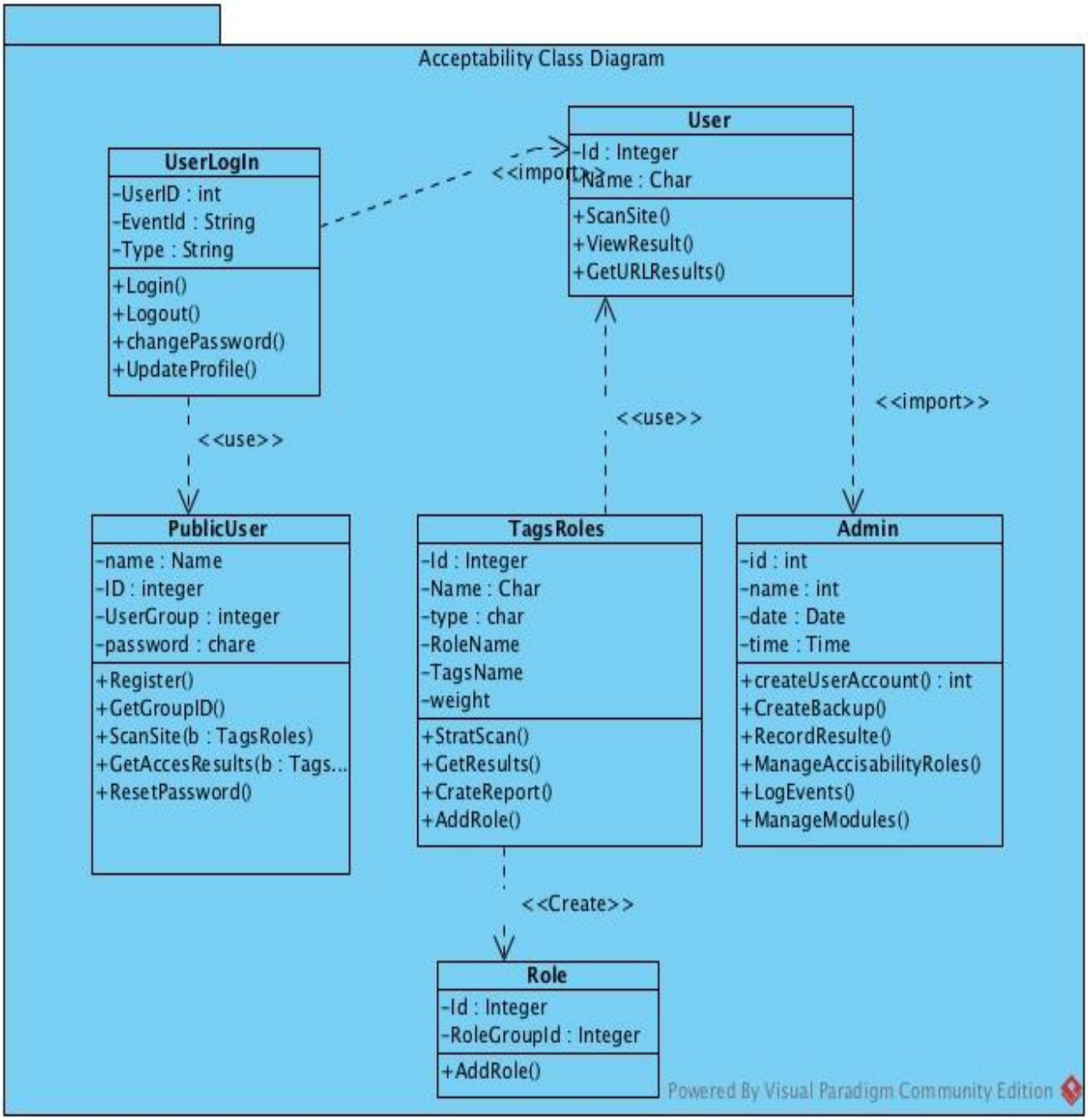

Figure 5.7: Acceptability Class Diagram

5.7 Entity Relationship Diagram:

Entity Relationship Diagram (Fig. 5.8).

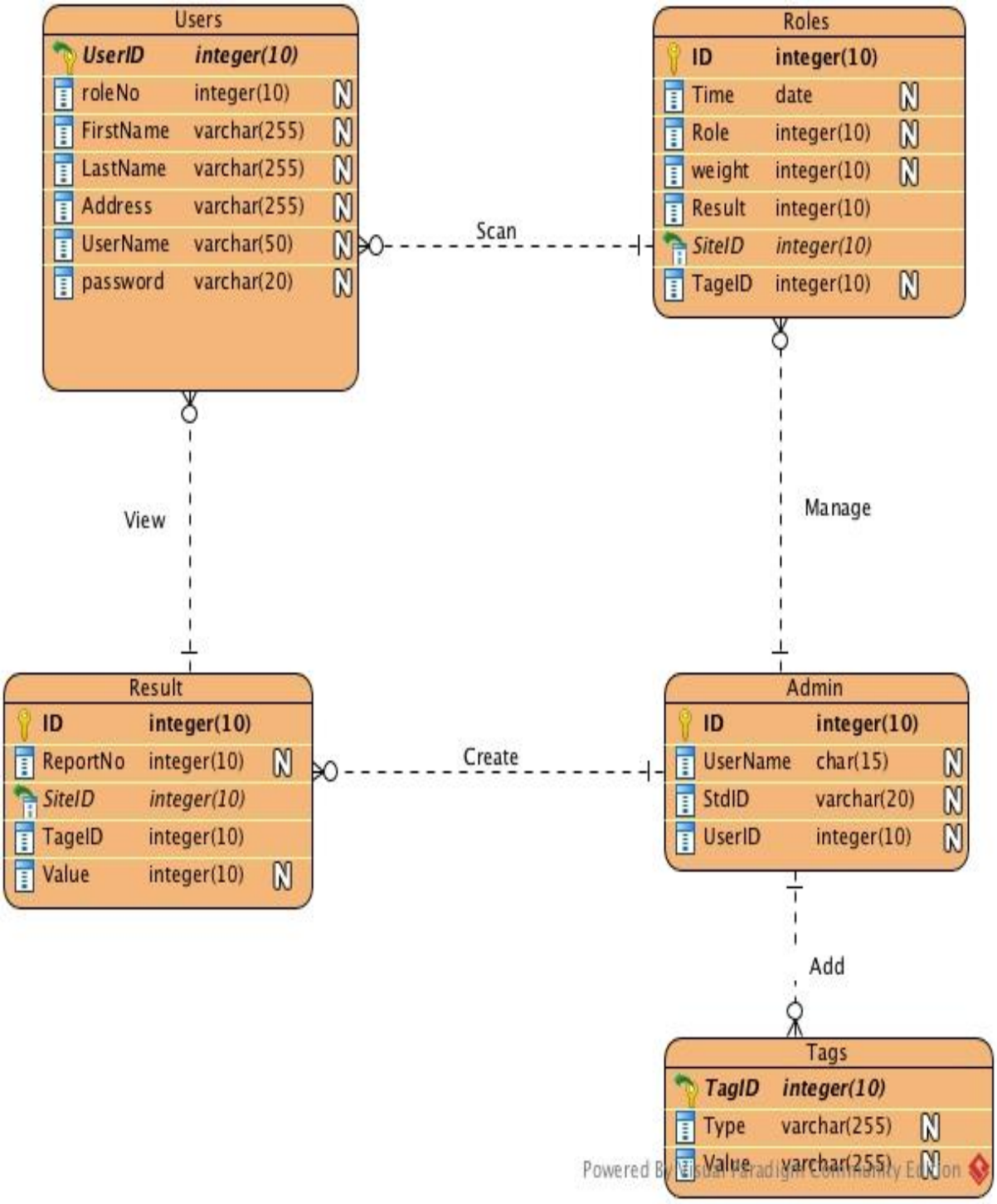

Figure 5.8: ERD Entity Relationship Diagram

6. IMPLEMENTATION AND EVALUATION

6.1 IMPLEMENTATION AND EVALUATION

Web Content Accessibility Guidelines version 2 (WCAG) [28] incorporate all guide and standers that are non-practice clients as instructor, understudy or substance made can utilize and covers a wide scope of suggestions for making Web content progressively available to help of individuals with inabilities, including visual impairment and low vision, deafness and hearing misfortune, learning handicaps, psychological constraints, restricted development, discourse incapacities, photosensitivity and mixes of these.

The Moodle platform allow developer to support accessibility by customized using themes and thousands of settings. As the content add by user for that to improve accessibility by improve process of continuous improvement in response Moodle users.

- Evaluation Accessibility for Moodle and Chamilo:

This section study Evaluation Accessibility for Moodle and Chamilo related to the following feature:

1. Accessibility Standards
2. Navigation
3. Color
4. Fonts
5. Audio accompanied by a text equivalent
6. Video accompanied by a text equivalent
7. PDFs as searchable text
8. using images and tables
9. Accessible lesson Using A Keyboard Without A Mouse

In (tab. 6.1) results of the analysis of the accessibility of the selected Turkey university web pages.

Table 6.1: Compare Chamilo with Moodle

Type	Moodle		Chamilo	
	Error	warning	Error	warning
Main site	20	70	9	2
login	6	6	13	7
Course category	12	26	9	82

Above table show results for moodle.kemerburgaz.edu.tr/moodle/ and campus.chamilo.org. results show that Moodle have errors and warning, next will describe main accessibility errors found:

Image Accessibility Error Example:
<img
src="http://moodle.kemerburgaz.edu.tr/moodle/theme/image.php/_s/academi/forum/1537946601/icon" ...

this error related to text alternatives, and it simply repair by system admin to write the alt tag on html code for text to identifies the task of the image.

- Color Accessibility Example:

To support user accessibility contrast should be between the color and the text with background for the item is not enough to match WCAG 2 stander for Level AA. What's more, it essentially fixes by utilize a shading contrast proportion of 4.5: 1 for the standard content, or 3: 1 bigger content to guarantee adequate complexity.

Below code for tested page for altinbas moodle site:

<h2>Info</h2>

Size of the example is fixed example for color contrast

Real sample size (18 points): Example of color contrast

CSS rules for the element:

External CSS (http://moodle.kemerburgaz.edu.tr/moodle/theme/styles.php/_s/academi/1537946601/all):

```
# Footer.footer-main {
    background: # 2d2d2d;
}
```

For accessibility module a browser parses website from URL submitted, then it creates a Document Object Model and scan all sub related and selected tags for the standers that should include like a tree (Fig. 6.1).

[29]Sometimes people will be viewing content and need to change the display to read it better, for example, make the text larger. If the place where they are reading (called “point of regard”) changes much, they lose their place and, especially with a small visible area and large text, it can be very difficult to find their place again.

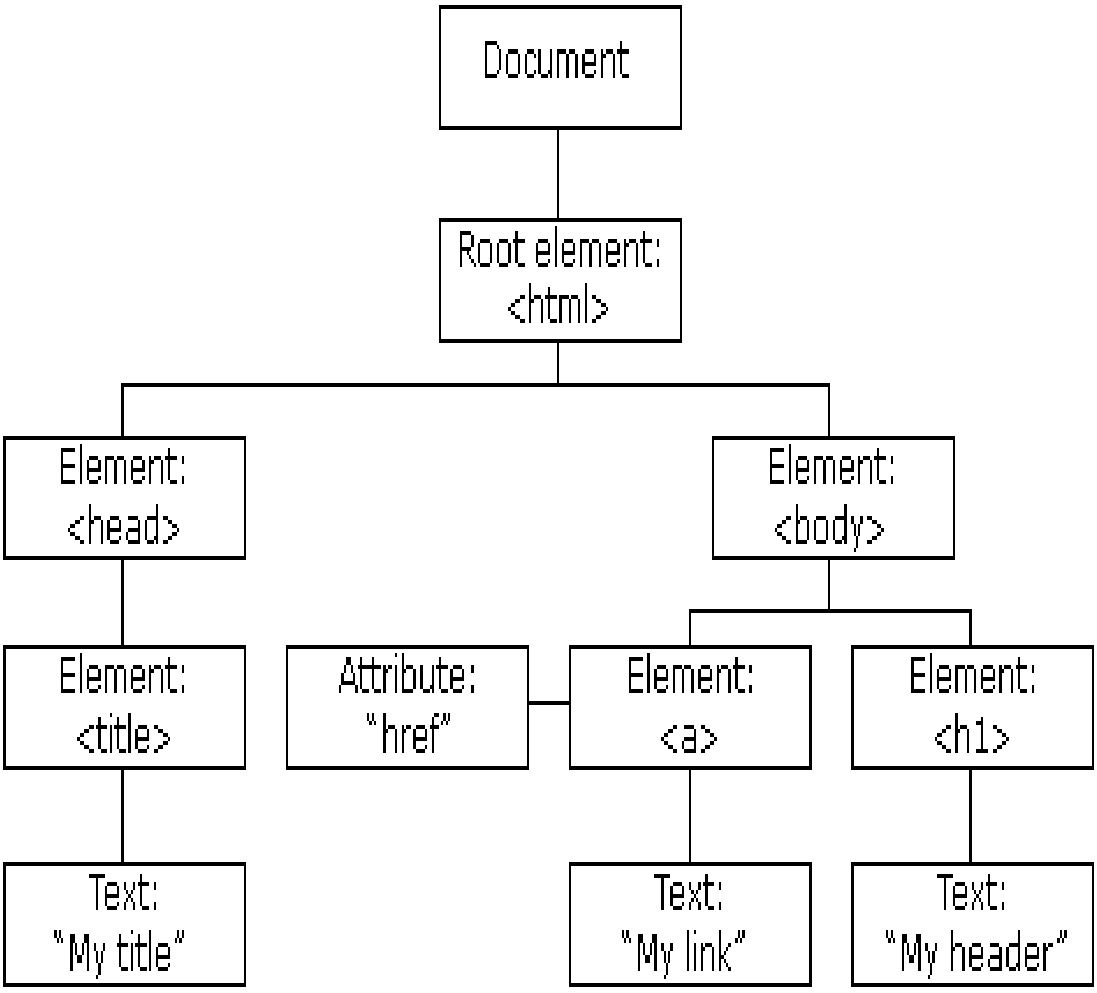

Figure 6.1: How System Work.

Another validation issue related to using ccs style, (Fig. 6.2) show the altinbas university Moodle site when we validate it using style and no style.

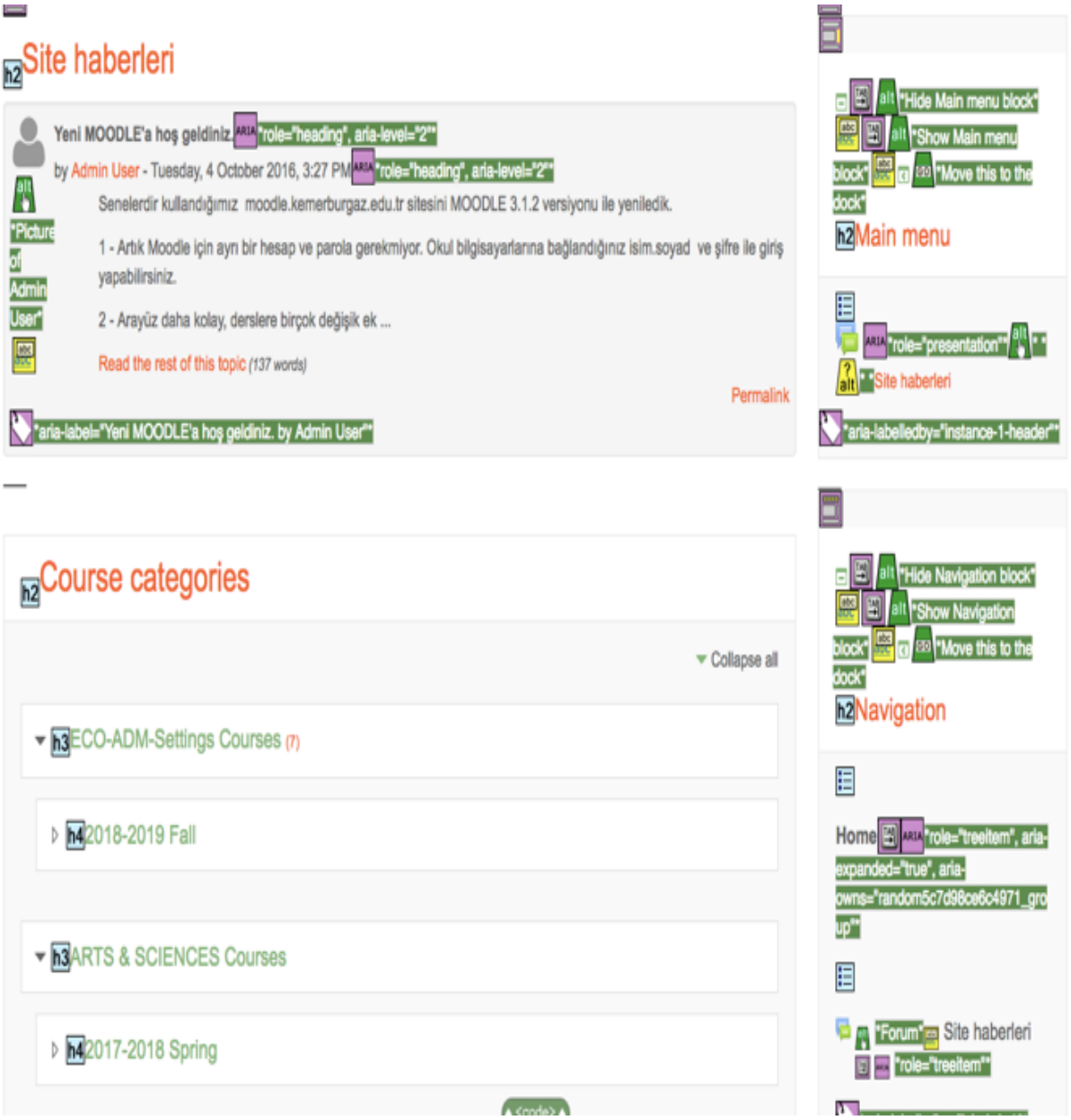

Figure 6.2: Altinbas Moodle with Style

The web designer develop website based on ccs style files, for accessibility user they known that didn't use style file, (Fig. 6.3) shown user screen for altinbas Moodle website after disable style file.

Figure 6.3: Altinbas Moodle No Styles.

While on Chamilo (Fig. 6.4) describe the compare between using style or no style.

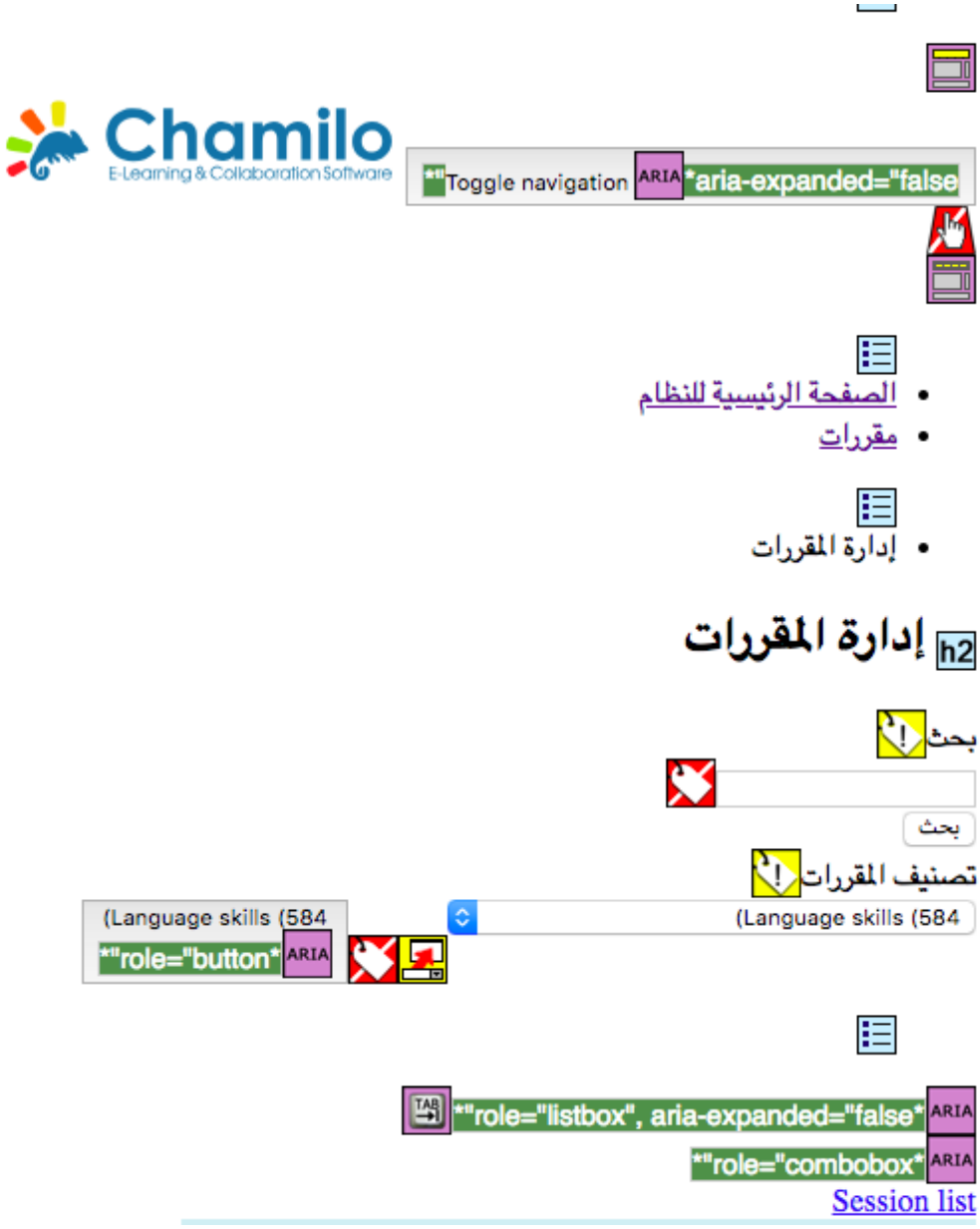

Figure 6.4: Chamilo With No Style

While (Fig. 6.5) Chamilo system with disable style.

Figure 6.5: Chamilo With Style Enable

6.2 IMPLEMENTATION FOR MODULE

To improve availability fundamentally we have to help shading contrast by making the complexity between hues as high as would be prudent, this will assist clients with reading content, [31] will help in designing an accurate link budget for a future enhanced system, expands openness and is commonly only simpler on the eyes, next recipe restores a highly contrasting shading.

```
ColorContrast(hex){

        return (parseInt(hex, 16) > 0xffffff/2) ? 'black': 'white';

}
```

For RGB color we assume that we have we have three value as: r →*Red*, g → *Green*, b → *Blue*, *each value should from 0* to 255 as we can use color space. YIQ recommended by the W3C and its the standard formula for calculating the perceived brightness of a color.

$$YIQE = ((r \ X \ 299) + (g \ X \ 587) + (b \ X \ 114)) / 1000 \quad (6.1)$$

Below is the function for calculating the YIQ color space

```
function
getContrastYIQ(hexcolor){
                        var r = parseInt(hexcolor.substr(0, 2), 16);
                        var g = parseInt(hexcolor.substr(2, 2), 16);
                        var b = parseInt(hexcolor.substr(4, 2), 16);
                        var yiq = ((r * 299) + (g * 587) + (b * 114)) / 1000;

                        return (yiq >= 128) ? 'black' : 'white';
                      }
```

For advance research we can use machine learning with set or library such as Brain.js for implementing machine learning approaches within web applications. Brain.js Its ease-of-use and started with neural networks and can add a lot of value to JavaScript/Node applications, below code describe how we can implement it simple and use

```
const brain = require('brain.js');

const data = require('./training-data.json');

const network = new brain.NeuralNetwork();

network.train(data, { log: true });

const result = network.run({ r: 0, g: 1, b: 0.65 });

console.log('result', result);
```

For predict if the text color should be black or white. The result as shown next:

iterations: 30, training error: 0.0061
iterations: 40, training error: 0.0058
iterations: 50, training error: 0.0056
iterations: 60, training error: 0.0054
iterations: 70, training error: 0.0052
iterations: 80, training error: 0.0050
result { white: 0.059, black: 0.94 }

6.3 SYSTEM ARCHITECTURE MOODLE MODULE

Moodle include and support a tool that available in the text editor (Fig. 6.6) that work to validate and check accessibility for some common errors in the text such as

Alt on Images, Contrast of font colors and background colors meets WCAG AA guidelines, tables caption and readable.

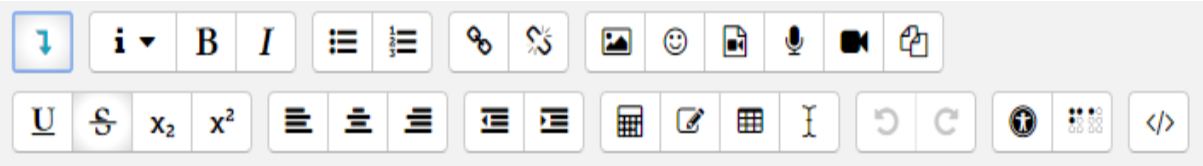

Figure 6.6: Accessibility Moodle Text Editor Checker.

To enable accessibility Moodle administrator should install and enable accessibility block that enable user to use accessibility feature in system, for our research we design Moodle course that include fully support accessibility user and user can use set of tools related to his case. Next figure shows the main course component and accessibility tools include with course.

The implementation of our module main role according to WebAIM's WCAG 2 [32] Checklist as following:

- Images and Video Modules Success Criteria:

1. All images tag <img > should include Alt text.
2. Related to images the <img > tag used, if iamge not include text, therefore we recommend to set null for alt property as text (alt="") and backgrounds add in CSS.
3. Form buttons have a descriptive value while form inputs have associated text labels.
4. User should note that Embedded multimedia is identified via accessible text.
5. For each media object should include recommends transcripts for all multimedia content.
6. Semantic markup using text ().

- Color Modules Success Criteria:

1. Colors isn't utilized as the sole technique for passing on substance or recognizing visual components.
2. Colors alone isn't utilized to recognize joins from encompassing content except if the different proportion between the connection and the encompassing content is in any event 3:1 and an extra refinement (e.g., it moves toward becoming underlined) is given when the connection is drifted over and gets the center.

- Writing Content Modules Success Criteria:

1. Text or images of text should have a contrast ratio of at least 4.5:1.
2. Large text size recommends typically 24px or 18.66px.
3. Text and images a contrast ratio of at least 7:1.

- Paragraph Text Modules Success Criteria:

1. Text under 80 characters wide and NOT completely legitimized with the satisfactory line separating min 1/2 the tallness of the content. For section separating (1.5 occasions line dispersing).
2. paragraph separating to multiple times the text dimension.
3. word separating to multiple times the text dimension, and letter dispersing to multiple times the text dimension.

6.4 SYSTEM ARCHITECTURE ACCESSIBILITY ANALYZER

Previous section describe in details the 3 modules that we will use to analyze accessibility and we named it as Altinbas eLearning web accessibility Evaluator, the main page how below (Fig. 6.7).

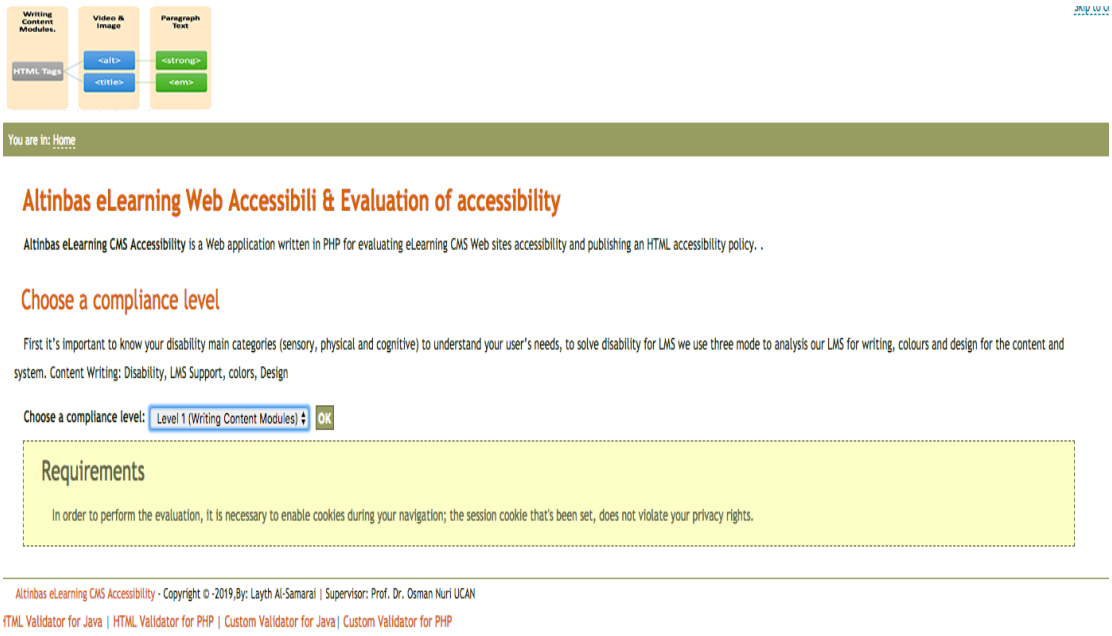

Figure 6.7: Altinbas eLearning Web Accessibility Evaluator

Altinbas eLearning web accessibility Evaluator support 3 modules, as describe in (Fig. 6.8).

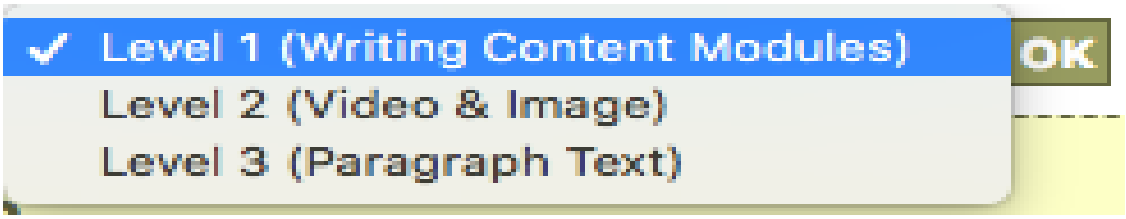

Figure 6.8: New system 3 modules

For validation, suggested new system support php and java Validator, and the developer can access it from footer links on the system, (Fig. 6.9) and (Fig. 6.10) show sample of Validator for Java and php.

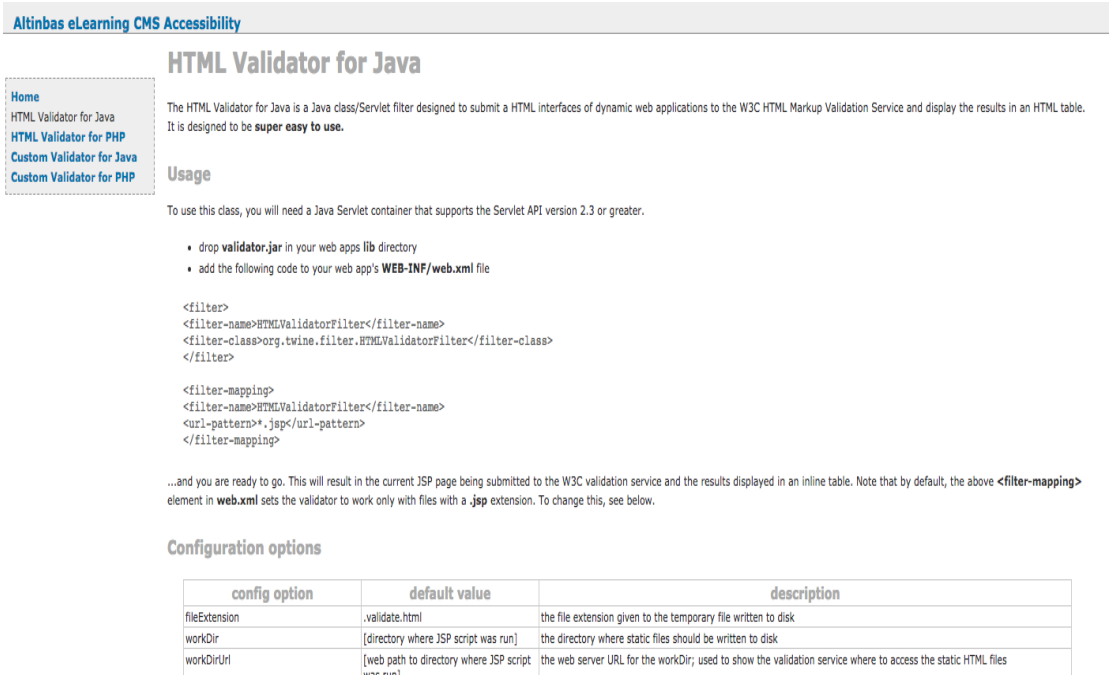

Figure 6.9: HTML Validator for Java

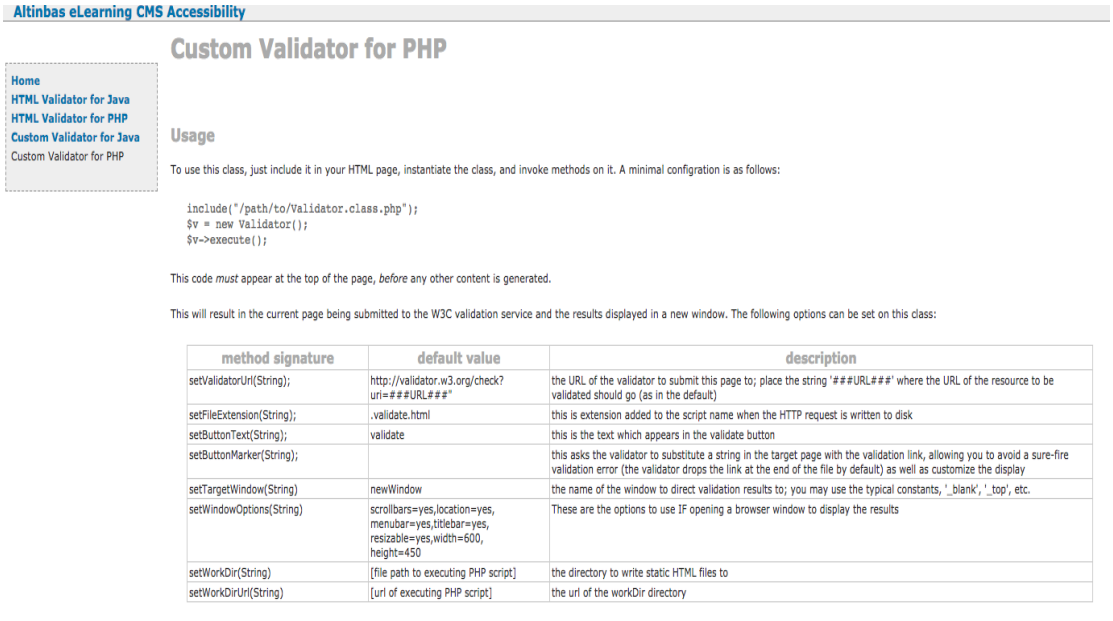

Figure 6.10: Custom Validator for Java

For validation and analyzes the site the user adds the title of the site and URL, then the system generate report shown the accessibility support or not for the site, (Fig. 6.11) shows the main page to submit the URL.

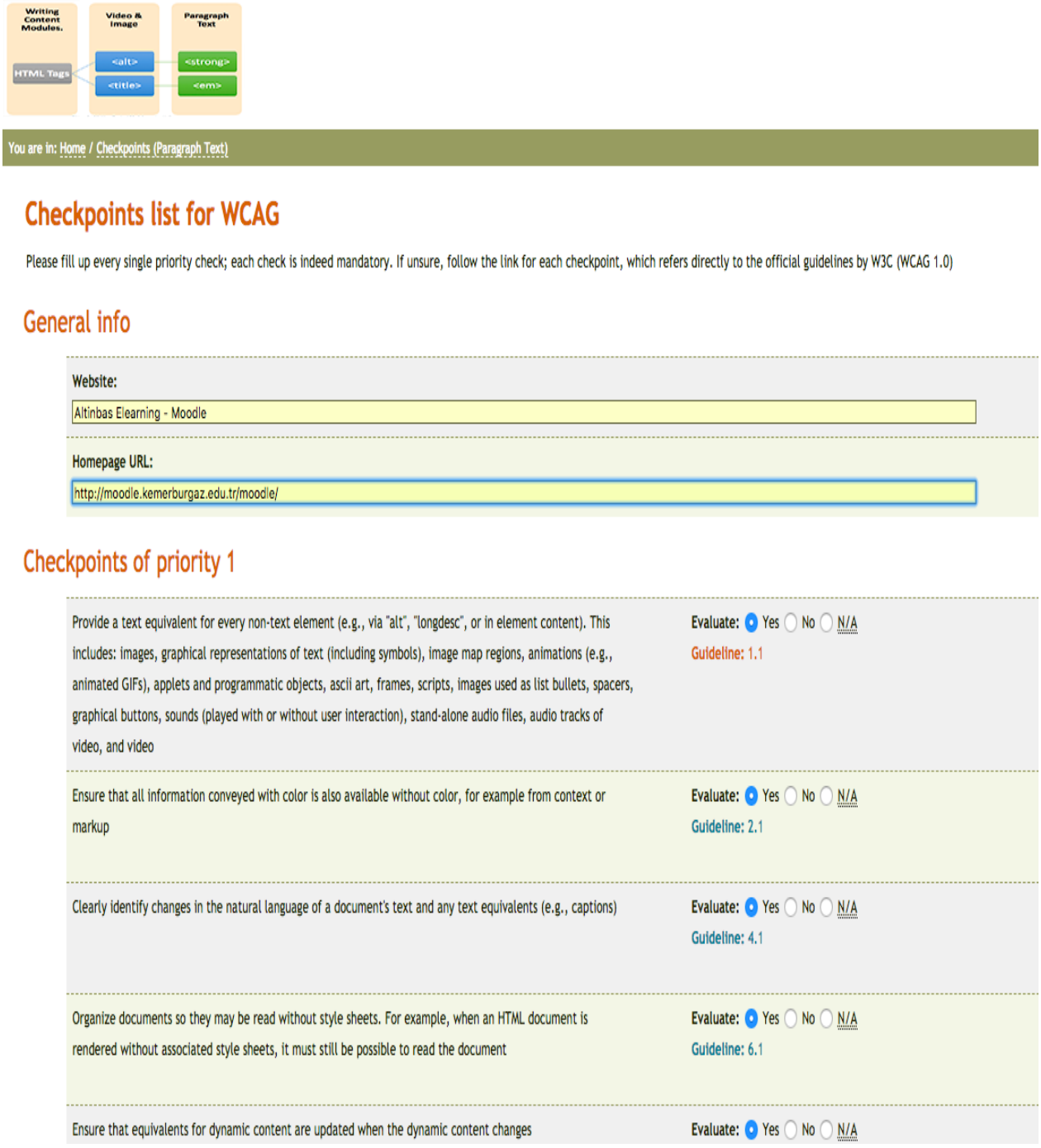

Figure 6.11: Validation and Analyzes

For validation and analyzes the site the user adds the title of the site and URL, then the system generate report shown the accessibility support or not for the site, (Fig. 6.12) shows the main page to submit the URL fiend code in APPENDIX A and B.

for site report include the summary about the site as shown below.

You are in: Home / Checkpoints (Paragraph Text) / Evaluation report

General report

Summary of technical data

- **Website:** Altinbas Elearning - Moodle (http://moodle.kemerburgaz.edu.tr/moodle/)
- **Time of the evaluation:** Tuesday 5 March 2019 01:51:22 CET

Priorities summary

Priority	Yes	No	N/A	Total	Result
Level 1 (Writing Content Modules)	16	-	-	16	Compliant
Level 2 (Video & Image)	30	-	-	30	Compliant
Level 3 (Paragraph Text)	19	-	-	19	Compliant

Guidelines summary

Guideline	Yes	No	N/A	Total	Result
.	65	-	-	65	Compliant
1. Provide equivalent alternatives to auditory and visual content	-	-	-	-	Compliant
2. Don't rely on color alone	-	-	-	-	Compliant
3. Use markup and style sheets and do so properly	-	-	-	-	Compliant
4. Clarify natural language usage	-	-	-	-	Compliant
5. Create tables that transform gracefully	-	-	-	-	Compliant
6. Ensure that pages featuring new technologies transform gracefully	-	-	-	-	Compliant
7. Ensure user control of time-sensitive content changes	-	-	-	-	Compliant
8. Ensure direct accessibility of embedded user interfaces	-	-	-	-	Compliant

Figure 6.12: Accessibility Report

6.5 BUILDING OUR MOODLE ACCESABILITY

We are creating our full Moodle and Add Accessibility tool for all users (Fig. 6.13,6.14,6.15).

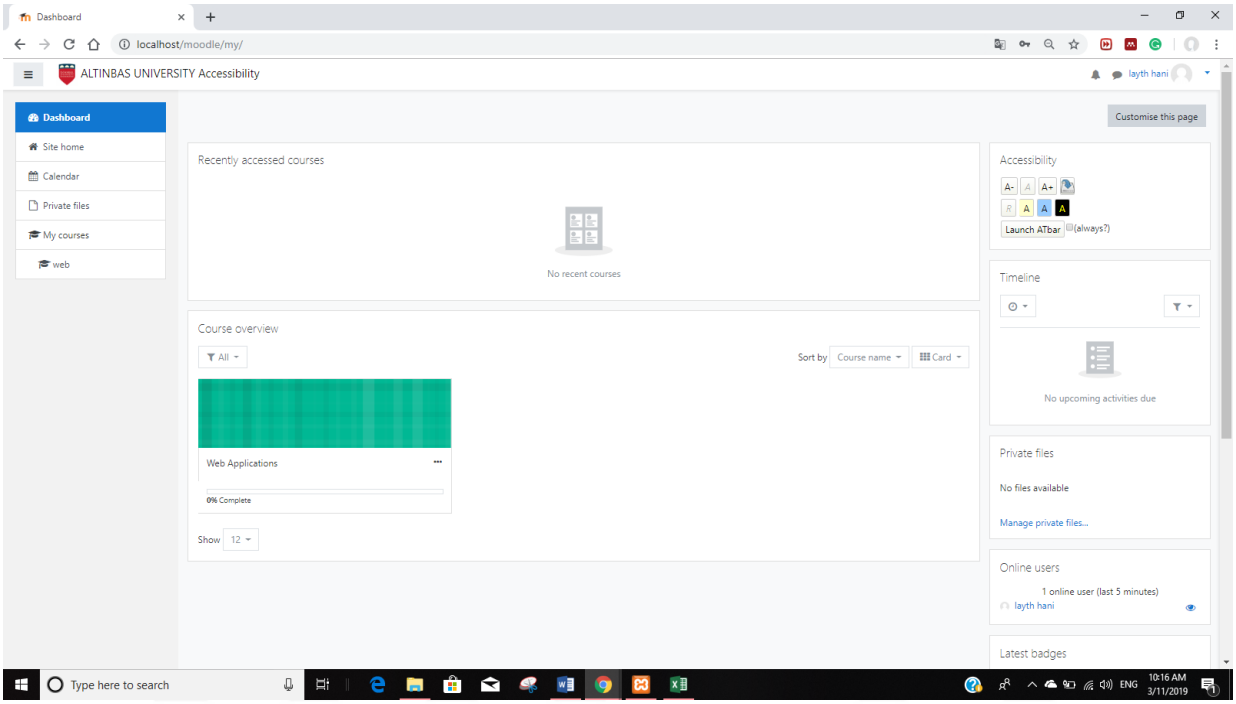

Figure 6.13: Moodle User Interface1

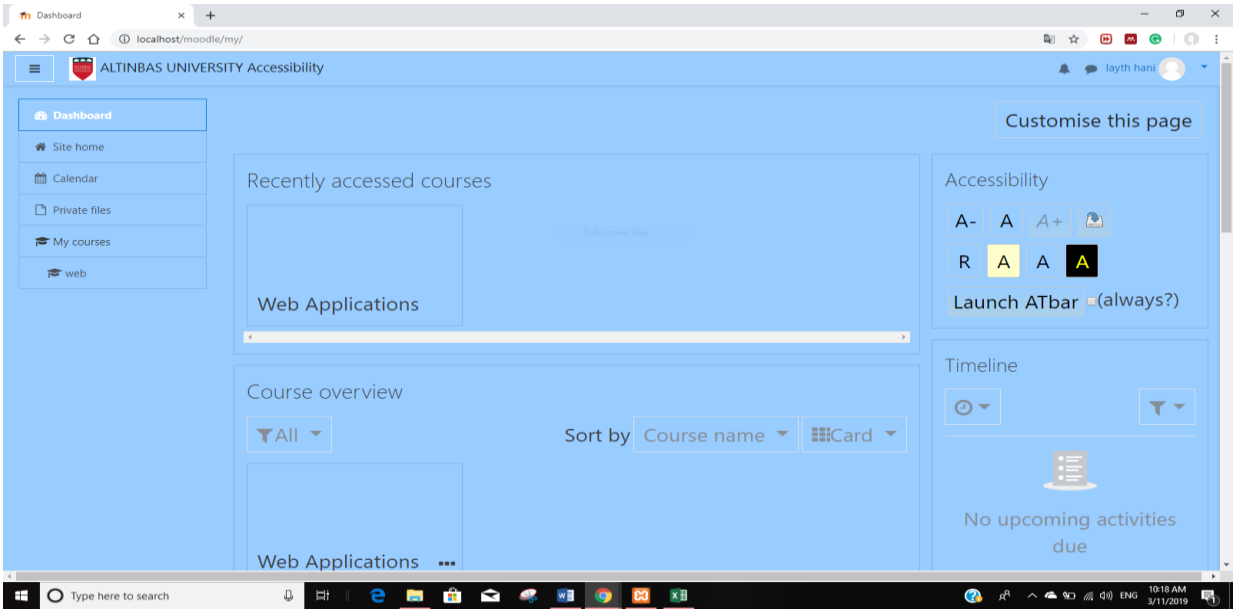

Figure 6.14: User Interface After Used Acces Tool

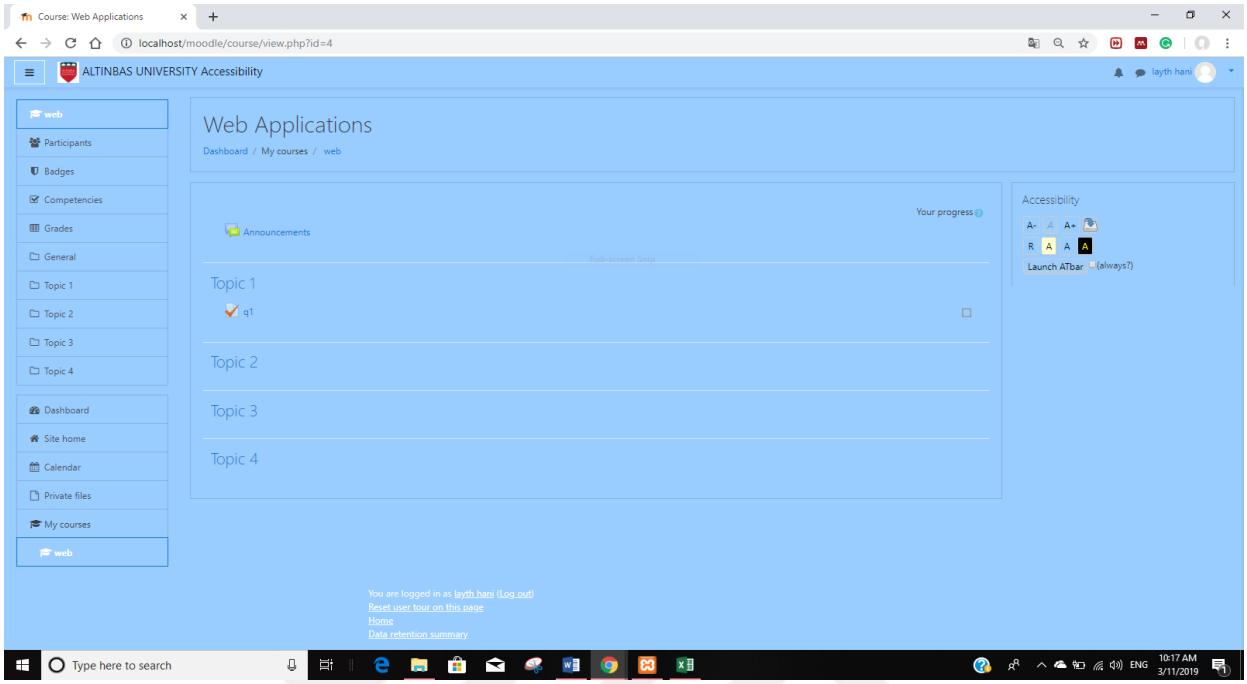

Figure 6.15: Course Full Stack

6.6 ACCESSIBILITY ALGORITHM SCAN EACH PAGE TO INCLUDE THE FOLLOWING MODULE

1. Images tag <img > and Video Modules Criteria, images the <img > tag used, if image not include text, media object should include recommends transcripts for all multimedia content (Fig. 6.16).
2. Color Criteria, if the different proportion between the connection and the encompassing content is in any event 3:1 and an extra refinement.
3. Writing Content Criteria, Text or images of text should have a contrast ratio of at least 4.5:1, Large text size recommend typically 24px or 18.66px, Text and images a contrast ratio of at least 7:1.
4. Paragraph Text Modules Success Criteria, [33] Simulation results show that the simulated genetic algorithm improve,. paragraph separating to multiple times the text dimension, Text less than 80 characters wide and NOT completely legitimized with the satisfactory line separating min 1/2 the tallness of the content, word separating to multiple times the text dimension, and letter dispersing to multiple times the text dimension.

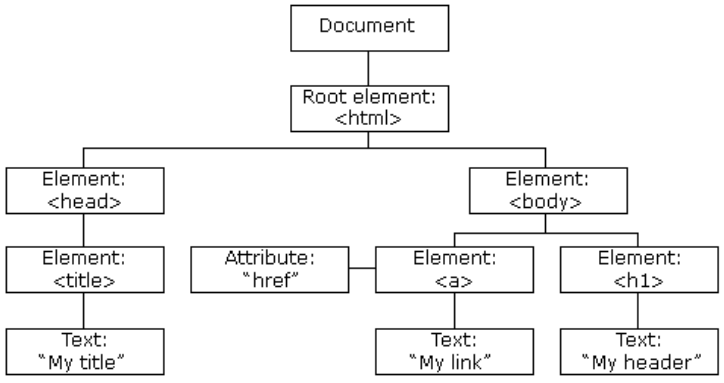

Figure 6.16: Algorithm Main Module to Scan Page with Hierarchical.

Our proposed (Fig. 6.17) algorithm to do the above modules as follow:

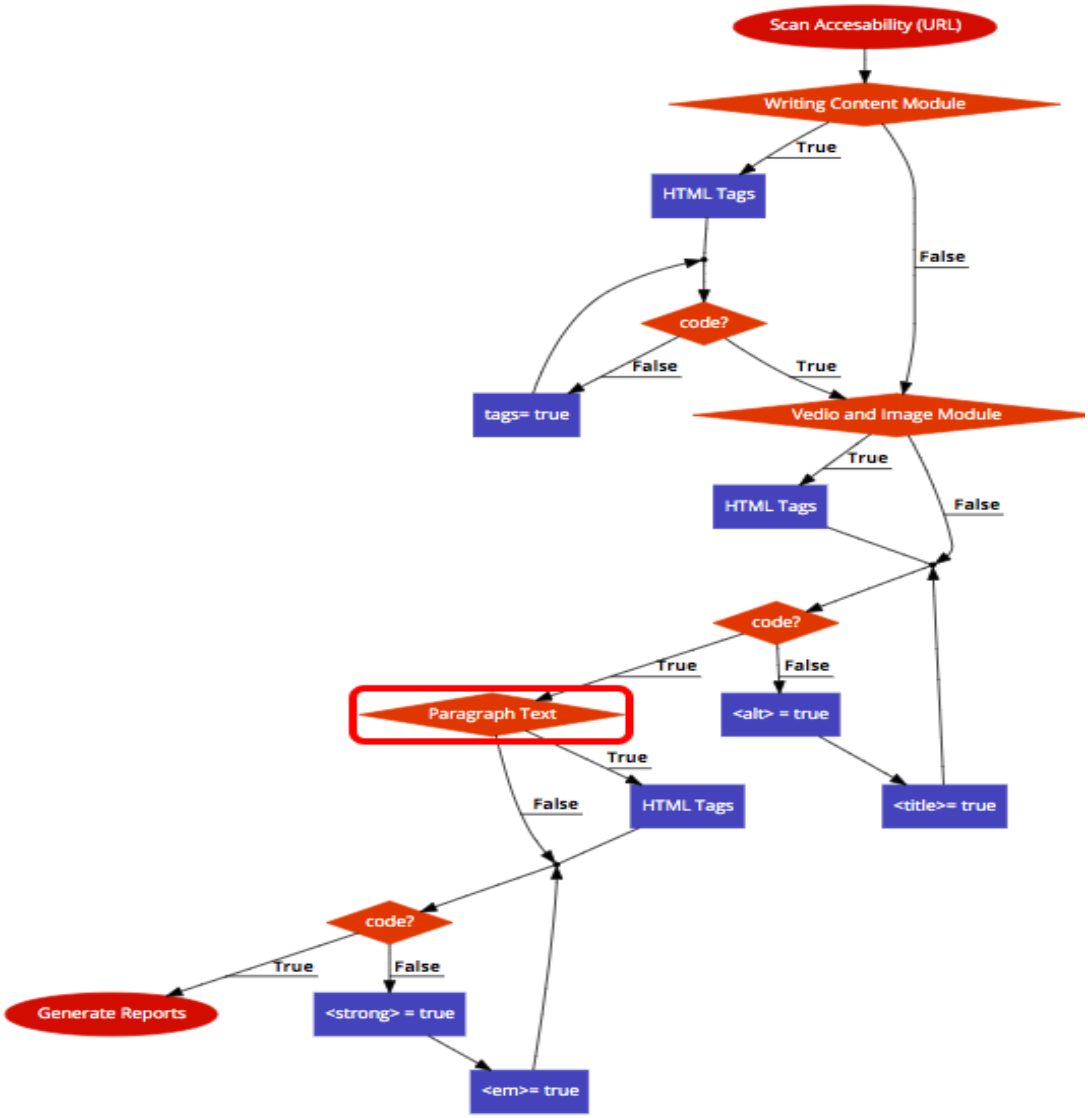

Figure 6.17: Accessibility Algorithm

To implement the above algorithm in simple step code in APPENDIX C.

Results of the analysis of the accessibility of the selected Turkey university web pages, by Evaluation our Accessibility algorithm that analyze Moodle and Chamilo for the following sub tags that include in html page, Accessibility Standards, Navigation, Color, Fonts, Audio accompanied by a text equivalent, Video accompanied by a text equivalent (Tab. 6.2), PDFs as searchable text, using images and tables, and Accessible lesson Using A Keyboard Without A Mouse.

Table 6.2: Analysis of The Accessibility of The Turkey University

Type	**Moodle**		**Chamilo**	
	Error	**warning**	**Error**	**warning**
Main site	20	70	9	2
Login	6	6	13	7
Course category	12	26	9	82

6.7 SPEECH ALGORITHM

Speech is a natural mode of communication for people. It plays a very important role in our daily lives. Not only in the speaking style, but also an efficient way of communication among the people. Speech is the primary thing for the people to express their feelings, The TTS conversion process should identify the text without any ambiguity and generate the corresponding sound output with naturally acceptable clarity. This means that the quality of the output TTS engine should be made as close to natural speech as possible (Fig. 6.18). [34]TTS systems generate speech equivalent for the text given as input. [35]processing of the speech signals is the most important part of speech recognition which is executed to remove avoidable waveform of the signal.

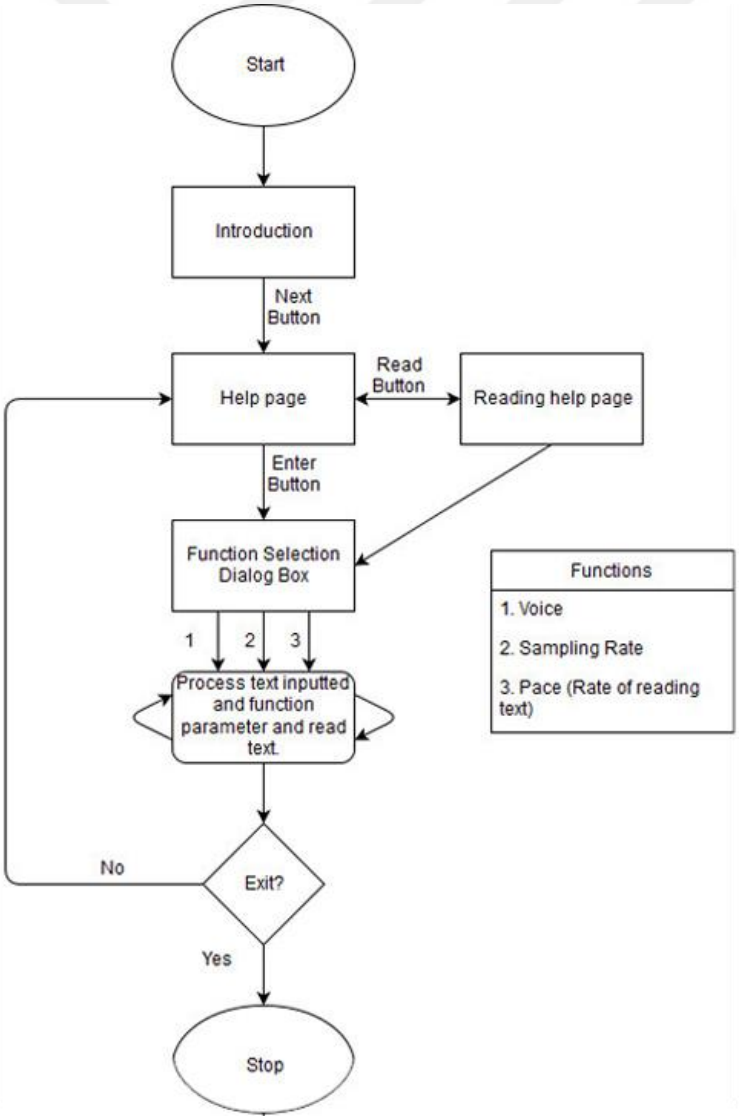

Figure 6.18: Speech Algorithm

By clicking onto the enter button [36], the user is introduced to a dialogue box containing options for manipulating voice, rate, the pace of the text to be read. The user will be directed to a page of his choice of a function where along with the application of the function.

the model has the potential to be applied in the cross-lingual environment. For instance, imitating a Chinese speaker’s voice to generate an English sentence can be done [37].

7. GENERAL CONCLUSION

7.1 GENERAL CONCLUSION

The main outcomes of the research to define new stander as guidelines for disability usage for LMS in higher and further education institutions, Disabled students experience a wide range of challenges in their study [38], the mere enumeration of supported features is a good metric for the potential of LMS to used [39], Educational institutions need to extend the accessibility of their courses to reduce those challenges. these results enable website designer and programmer to support system disability by enhance the system and analysis it for student to develop improved system that enable disability student to use eLearning CMS.

7.2 MAIN CONTRIBUTIONS

Our main objective to design methodology or stander to indicate if accessible LMC is support disability users to facilitates full interaction by all users.

7.3 APPLICATION AREAS AND FUTURE WORK

ePub3[40], is becoming popular in the corporate e-learning environment and alternatively electronic publication offers a complete range of semantic and systematic ways including the impaired readers ePub3 support accessible by allows content to be tagged with a variety of components such as content, assignment and activity.

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APPENDIX A

CODE INDEX ACCESSIBILITY MOODLE

```
<?php

// Requires the configuration file
require_once ('config.inc.php');

// Checks for the language to be set
if (isset($_REQUEST['lang'])
   && $_Wuhkag['available_languages'][$_REQUEST['lang']])
   $lang = $_REQUEST['lang'];
else
   $lang = getUserLanguage($_Wuhkag['available_languages'],
      $_Wuhkag['default_language']);

// Set the locale
setlocale(LC_ALL, $_Wuhkag['locales'][$lang]);

// Requires the specific language class
eval("require_once ('classes/wcag10_$lang.class.php');");

session_name('wuhkag-sessid');
session_start();

$phase = START;
//include top toolbar
include('toolbar/index.php');
```

```
if (isset($_GET['level']) && WCAG10::checkLevel($_GET['level']))
{
   $_SESSION['wcag10']->setLevel($_GET['level']);
   $phase = FORM;
}
else
{
   if (isset($_SESSION['wcag10']))
   {
      if ($_SERVER['REQUEST_METHOD'] == 'POST')
      {
         if(!$_SESSION['wcag10']->checkAnswers())
            $phase = FORM;
         else
            $phase = REPORT;
      }
      else if (isset($_GET['modify']))
         $phase = FORM;
      else if (isset($_GET['report'])
         && $_SESSION['wcag10']->getPhase() >= FORM
         && $_SESSION['wcag10']->checkAnswers()) // Previous phase was at least the report
            $phase = REPORT;
      else if (isset($_GET['policy'])
         && $_SESSION['wcag10']->getPhase() >= REPORT) // Previous phase was at least the
report
            $phase = POLICY;
      else if (isset($_GET['chglang']))
```

```
        unset($_SESSION['wcag10']);
    }
}

if (isset($_SESSION['wcag10']))
    $_SESSION['wcag10']->setPhase($phase);

// For every phase, let's perform a specific action
switch ($phase)
{
    case START:
        // We're in the first phase, selection of the priority level of the report
        eval("\$_SESSION['wcag10'] = new WCAG10_$lang();");
        $_SESSION['wcag10']->printHTMLSelectForm();
        break;
    case FORM: // Form for the checkpoints
        $_SESSION['wcag10']->printHTMLForm(); // prints out the form
        break;
    case REPORT:
        $_SESSION['wcag10']->analyseAnswers(); // analyse the answers ...
        $_SESSION['wcag10']->printHTMLReport(); // ... and prints out the report
        break;
    case POLICY:
        $_SESSION['wcag10']->printHTMLPolicy(); // prints out the policy
        break;
}
?>
```

```
<div id="nav">

   <a href="validator/doc/javahtml.html">HTML Validator for Java</a> |
   <a href="validator/doc/phphtml.html">HTML Validator for PHP</a> |
        <a href="validator/doc/java.html">Custom Validator for Java</a>|
   <a href="validator/doc/php.html">Custom Validator for PHP</a>
</div>
```

APPENDIX B

CODE CONFIG ACCESSIBILITY MOODLE

```
<?php
if ( defined( '__CONFIG_INC' ) ) return;
define( '__CONFIG_INC', 1 );

// Constant definitions
define ('YES', 1);
define ('NO', 0);
define ('NA', 2);
define ('TOTAL', 3);
define ('RESULT', 4);
define ('PARTIAL', 5);

// Application phases
define ('START', 0);
define ('FORM', 1);
define ('REPORT', 2);
define ('POLICY', 3);
// Get the translation table for characters
$XSS_table = get_html_translation_table(HTML_ENTITIES);
$XSS_table['('] = '&#40;';
$XSS_table[')'] = '&#41;';

// Wuhkag version
define ('wuhkag_version', '0.1b3');
```

```
// General configuration
$_Wuhkag = array();
// Language settings
$_Wuhkag['available_languages'] = array (
    'it' => false,
    'en' => true
);
// Default language
$_Wuhkag['default_language'] = 'en';
// Locale settings
$_Wuhkag['locales'] = array(
    'it' => 'it_IT',
    'en' => 'en_EN'
);

// Language names
$_Wuhkag['language_names'] = array(
    'it' => 'Arabic',
    'en' => 'english'
);

// Requires functions file
require_once ('./include/functions.inc.php');
?>
```

APPENDIX C

ACCESSIBILITY ALGORITHM SCAN CODE

```
Scan Accessibility (URL);

if (Writing Content Module) {

  HTML Tags;

  while (! code?)

    tags= true;

}

if (Video and Image Module)

HTML Tags;

  while (! code?)

    {

    <alt> = true;

    <title>= true;

    }

if (Paragraph Text)

HTML Tags;

  while (! code?)

    {

    <strong> = true;

    <em>= true;          }
```

Generate Reports;

To implement the algorithm using php code to analysis all modules they select by user:

```
function scanURL()

{

$guidelines    =    Whis->_results['guidelines'];
$priorities    =    Whis->_results['priorities'];
$level = Whis->_resultsUlevell;

$level = 0; // default value

$compliant_guidelines      =      Whis->_results['compliant-guidelines'];
$compliant_guidelines = array();

$partial_guidelines      =      Whis->_results['partial-guidelines'];
$partial_guidelines = array();

$this->_info['time'] = time();

for ($i = 1; $i <= $this->_level; ++$i)

          if (($priorities[$i][YES] + $priorities[$i][NA]) == $priorities[$i][TOTAL])

    {

if ($i > 1)

            $priorities[$i][RESULT]          $priorities[$i - 1][RESULT];

        else

            $priorities[$i][RESULT] = YES;

    }

    else

        $priorities[$i][RESULT] = NO;

    if   ($priorities[$i][RESULT]   ==   YES)
        $level = $i;

}

while (list($gl, $stats) = each($guidelines))

{

    if (($stats[YES] + $stats[NA]) == $stats[TOTAL])
```

```
    {
        $guidelines[$gl][RESULT]   =   YES;
        $compliant_guidelines[] = $gl;
    }
    else
    {
        if ($stats[YES] > 0 && $stats[NO] == 0)
        {
            $guidelines[$gl][RESULT]   =   PARTIAL;
            $partial_guidelines[] = $gl;
        }
        else
function GenReport($level)
{
    global $XSS_table;
    if (!isset($this->_compliance_levels[$level]))
        return '';
    else
        return strtr($this->_compliance_levels[$level], $XSS_table);
}
function printHTMLGuideline($level)
{
    global $XSS_table;
    if eissetUthis->guidelinesDlevelp)
        return '';
    else
        return strtr($this->_guidelines[$level], $XSS_table);
}
```

```
function printHTMLCheckpoint($level, $number, $what)
{
    global $XSS_table;
    if eissetUthis->_checkpoints[$level][$number][$what]))
        return '';
    else
                return strtr($this->_checkpoints[$level][$number][$what], $XSS_table);
```