



Information Architecture Analysis for User Interface Design (Case Study: E-learning Platform for Users with Disability)

Kostandina Veljanovska

Department of Intelligent Systems, Faculty of ICT, University "St. Kliment Ohridski", Bitola, Republic of Macedonia
(kostandinav@gmail.com)

Abstract-The rights of every human being are guaranteed by International human rights law and provide having equal possibilities in the right to life and liberty, freedom, freedom of opinion and expression, the right to work and education, and many more. Persons with disabilities are entitled to exercise their civil, political, social, economic and cultural rights on an equal basis with others. This paper formalizes the process of creating an information architecture for a specific issue that enables users with disabilities to realize their right to educate about their health on an equal basis with every other person. User interface for e-learning platform for users with disability is designed in this research and the whole process of information architecture design is analyzed.

Keywords- *Information Architecture, User Interface, e-Learning Platform, Human-Computer Interaction, People with Disabilities, WCAG, e-Health, Digital Literacy, Health Literacy*

I. INTRODUCTION

Living in a time when we are surrounded with digital appliances in our day-to-day life, the interaction with those appliances becomes crucial for every human being. Human – computer interaction becomes very important issue when people are at old age or have some condition that makes it more difficult for a person to do certain activities or interact with the world around them. Designing a user interface for a digital product for the people with disabilities is a challenge for every designer. United Nations Educational, Scientific and Cultural Organization (UNESCO) states that ‘many initiatives have been taken to support the right to education of persons with disabilities’. By creating accessible, barrier-free and inclusive learning, information and communication technology (ICT) is a growing field of interest and offers unprecedented possibilities to ensure the right to inclusive education. [1] This paper addresses the research that encompasses the whole process of user interface design for e-learning platform for users with disability and elderly people for e-health. The process is very broad and has specific steps that were followed. The first chapter of this paper explains how we start with the designing process. The second one is description of the model we established for user interface design. The third part contains real prototypes of user interface design for the e-learning platform for disabled and elderly people.

II. INFORMATION ARCHITECTURE FOR WEBSITE

A. *The basis of digital products design*

All great digital products start with information architecture (IA) which is the basis of websites, mobile applications, multimedia products and videos. It is said that ‘one of the most frustrating things while creating a website or any digital product is being an information architect’. Good information architecture is a foundation of efficient user experience, so the IA skill is essential for the designers. Effective IA makes the product easy to use but only united with design the product has the powerful user experience.

Information architecture (IA) is a science of organizing and structuring content of the websites, web and mobile applications, and social media software. [2] Information architecture is the practice of deciding how to arrange the parts of something to be understandable. According to Nielsen Norman Group information architecture could be defined as ‘the underlying organization, structure and nomenclature that define the relationships between a site’s content and functionality’. [2, 3] They consider information architecture (IA) as the bones, user interface (UI) as the skin and user experience (UX) as the heart of a website or any digital product. IA could be presented as half-art-half-science process of deciding how the content of a digital project would be organized and labeled. If the user encountered great information architecture many times, and never realized it, it is really well designed IA. In fact, IA is a behind-the-scenes process, while the user interface is the front line of any digital product. User interface (UI) design encloses everything starting from the accessibility and usability of a product and ending with its graphic details and typography [4]. Good UI means that customers need to be able to accomplish tasks without any special effort, easily and intuitively. [4]

The final aim of great IA and UI design is the overall user experience (UX), which is the emotion that people feel while using the product. UX designers should make things more profound, targeting their users on an emotional level. User experience can have a strong impact on an overall product.

In order to design a website, web designers have to understand how to create synergy among IA, UI, and UX and to enable these three parts to work together.

If we want to define the components of IA we could say it should contain four main components: organization systems, labeling systems, navigation systems and searching systems.

B. Information Architecture Concepts

Architecture of the webpage incorporates the structure, relations, connectivity, local organization and dynamic relations among the parts of the webpage. In every web page positioning, layout, visual effects, fonts and style of the content are crucial, but are more on the side of internal design than architecture. But, architecture and design are tightly connected. When website architecture imitates real life architecture, orientation and navigation are becoming intuitive. First you have to start with IA and layout design. The most common mistake is to start creating website without creating layout, i.e. actual positioning and arranging textual contents and pictures in two-dimensional space [5].

There are six IA concepts: [4,5,6] defining goals, defining audience, creating and organizing the content, formulating the concepts for visual presentation, developing the map of the website and navigation and designing and producing the visual forms.

- Defining the goals

The first step is to make a survey of the key people in order to get a clear idea of the content of the page. You have to create questions in order to determine the mission of the page. The second step is to define the scope of the project and the time needed to finish the creation process.

- Defining the audience

This step has its aim in determining the users of the website and their goals and intentions. This means information architect has to define user experience, to understand how the users will react when they visit the web page. Scenario has to be written (story that describes the steps) for all future users. Scenario defines user experience and enables the designer to improve the visualization and to connect with the audience.

- Creating and organizing the content

The written text and pictures arranged on a page are usually written by marketing department, or PR team on the side of a client or by the team of designers. They organize the content in sections, create list of requirements for the functionalities, name the content and group it. They have to name each group choosing the most descriptive names. The discussion with the clients and team members is necessary in order to check if grouping fulfils expectations and satisfies functional requirements. Final grouping will be used to define sections of the site. After completing the content, priorities are determined.

- Formulating the concept for visual presentation

The concept or the idea we want to present is a visual direction, or theme for the site. It is crucial to keep the concept simple. We start by writing the concept in two sentences. [5,6]

- Developing the map of the website and navigation

The site map is all-inclusive schema with diagrams of the site which explains the organizational structure of the site. The map (plan) of the site is synonym with the structure of the site and in the best way it composes the map of the main sections of the site and constructs forms in layers.

- Designing and producing the visual forms

Visual form is the website outlook, i.e. layout, type, graphics, logo, diagrams, pictures, illustrations. Visual form as a creative part of the website identifies the client, creates brand, it creates outlook, feeling and mood for the site. It creates overall user experience. [5, 7]

After completing these six concepts, we proceeded with layout design, although in the last concept layout design is already reviewed. There are four steps for layout design: brainstorming, sketching the ideas if a very small format, creating more inclusive schema and finally creating real layout which includes graphics, templates for the pages, etc.

III. MODELLING THE USER INTERFACE

During our research in creating an e-learning platform for digital literacy for elderly and disabled people we have started by designing information architecture according to the six concepts. We have defined user requirements according to the WCAG 2.0 standards and our computer science experience [8, 9]. Systems requirements were also determined, such as: website to fulfil WCAG 2.0 to level AA, for each non-textual content to have alternative ways to represent them, all textual content should have possibility of zooming up to 200 %, and many others.

Creation of UI continued with defining users. There are three types of them: primary, secondary and tertiary users. Primary users are people mainly interested in broadening their health knowledge by digital devices and have direct access to the system we are developing. We divided that group of primary users in several smaller groups (subtypes): elderly people, disabled people with different types of disability and children. Secondary users are people that develop the e-learning platform and design user interface such as: graphical designer, user experience designer, user interface designer, multimedia editor, content manager, e-learning experts. As tertiary users we determine people that are directly affected by the success of the system, although they are not in direct interaction with it, such as: investors, courses authors, administrators, pedagogues, marketing companies.

After this stage we develop scenarios for each group of users taking into account the motivation of users, their aim and external influences and we develop profiles accordingly for better understanding their way of thinking.

In the phase of modelling the most powerful representation of scenarios is by UML diagrams. While describing interaction between users and e-learning platform in different situations, we decided that the best way to represent functional requirements is by use-case diagrams (Figs. 1,2,3).

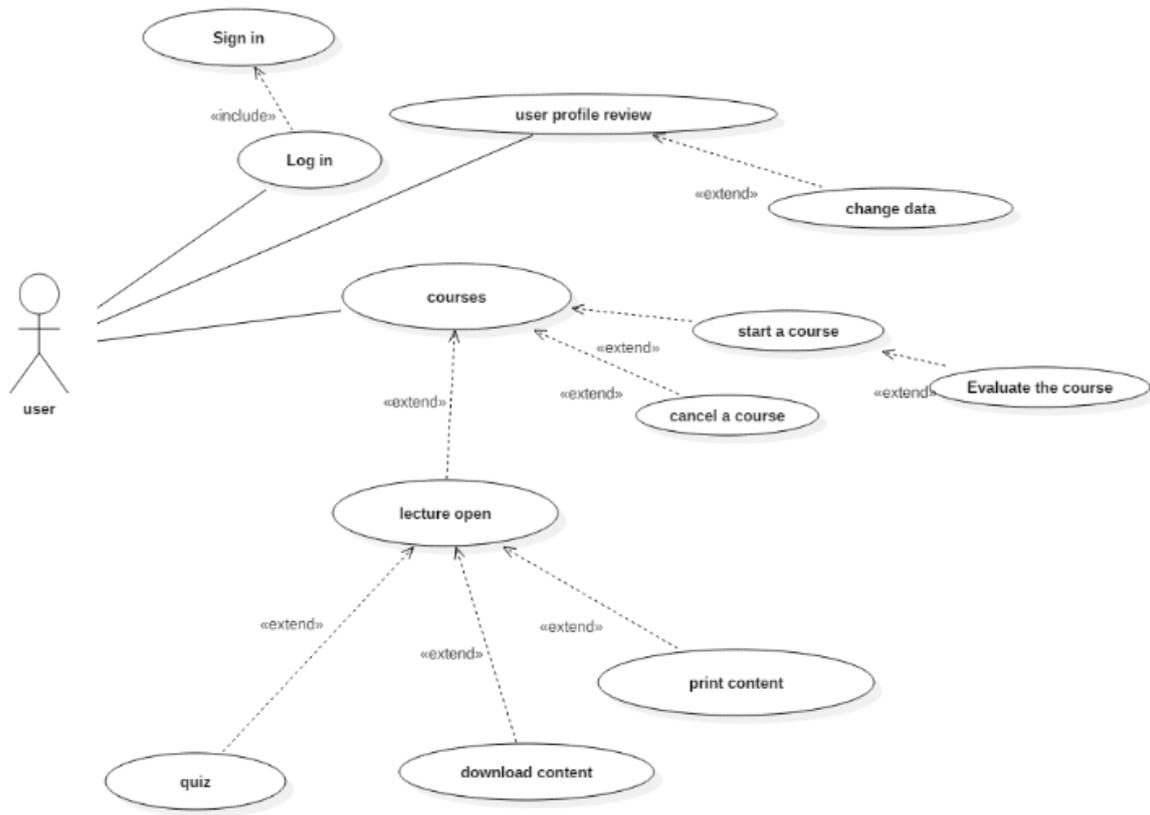


Figure 1. Use case diagram for registered user

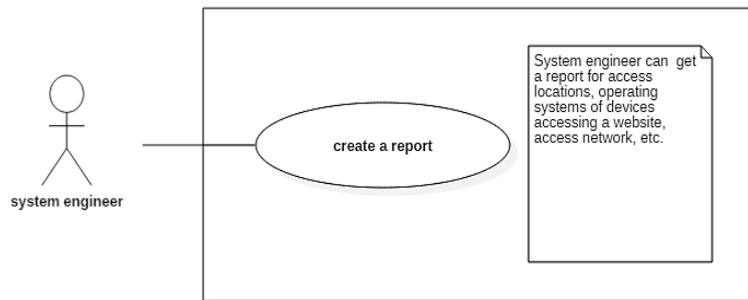


Figure 2. Use case diagram for system engineer

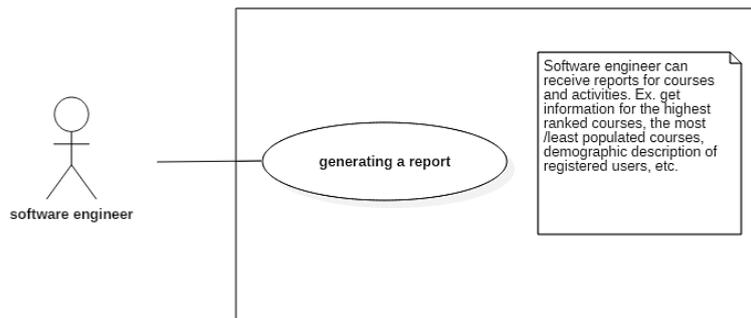


Figure 3. Use case diagram for software engineer

In order to describe the dynamical nature of the e-learning platform we use diagram of machine states to represent the web site navigation, or state changes for both registered and unregistered users.

We also use diagrams of activities to describe the working flow for the user (Figure 4.).

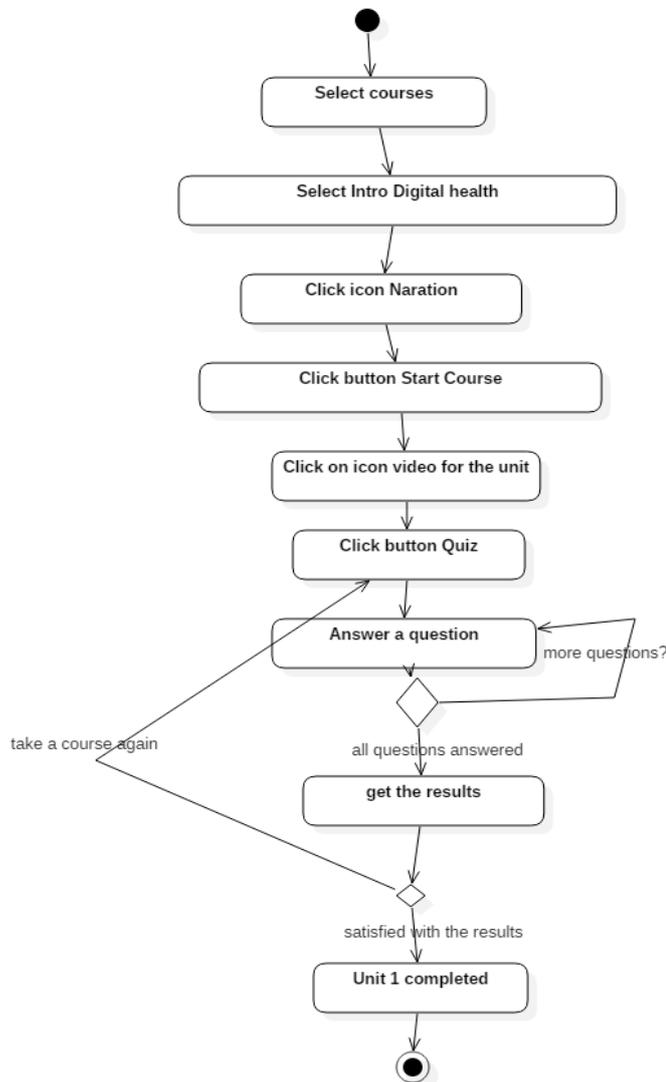


Figure 4. Diagram of activities for beginning the course, passing first lecture and taking a quiz

IV. USER INTERFACE DESIGN – LAYOUT PROTOTYPE DEVELOPMENT

A layout for each page has to be aesthetically attractive from one side, and from the other to communicate effectively the content of the page to the audience of that page. In our research we have done two types of prototyping for the layout using similar ideas. In the first stage of developing our e-learning platform, several topics, such as high blood pressure, diabetes and good nutrition for a healthier life, were

considered. The types of disabilities taken into consideration were audio and visual disabilities. The list is planned to be broadened in the second phase, and the content would be enriched in terms of enlarging the types of disabilities and topics of lectures covered. It is important to mention that all of the screens are meant to be flexible regarding orientation and size, and applicable to different browsers and to various operating systems. The process of user interface design starts with creating a prototype for UI and its menu according to the WCAG 2.0 standards.

The menu opens giving the user opportunities to see and / or to hear what appeared on the screen.



Figure 5. The main menu for language selection addressing visual and audio disability.

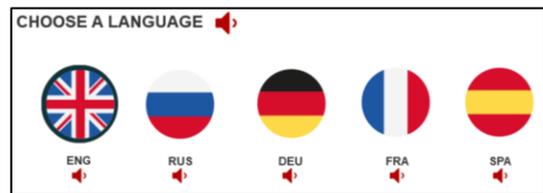


Figure 6. Language selection screen for the next phase of the project

The idea is to offer a clean screen in order not to confuse the users with a disability or older people when they try to read or click on a content when a new screen appears in front of them.

The first page of e-learning platform is the Digital literacy screen where user can gather some knowledge regarding digital literacy in general. (Figure 7)



Figure 7. Digital literacy information page.

The user is also able to open Health literacy from the main menu to acquire knowledge for human health in general. By selecting “Courses” in the main menu, the courses will appear on the submenu and on the screen. The submenu courses contains several items and the user could select from the vertical menu on the left side whether to select Introduction, Digital literacy for the specific course, basic symptoms, prevention or actions to be taken in case of disease, or to take a quiz for that disease.

E-learning platform offers possibilities of learning for the people that are not able to see properly or to hear properly, i.e. people with disabilities to some extent and not completely disabled. Digital literacy for each type of disease is offered.

Basic symptoms for each disease are offered respectively (Figure 8).

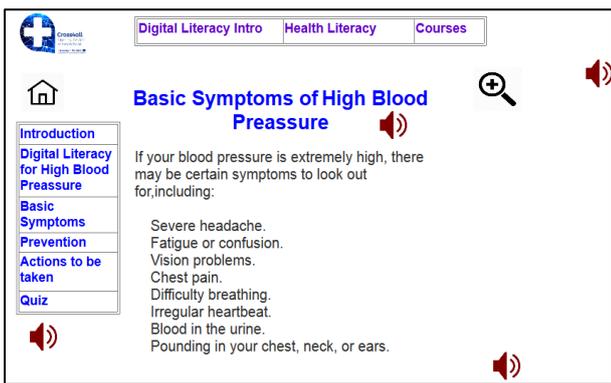


Figure 8. Basic symptoms page.

The user could select to read or hear about the prevention of diabetes or other diseases offered in the platform (Figure 9).

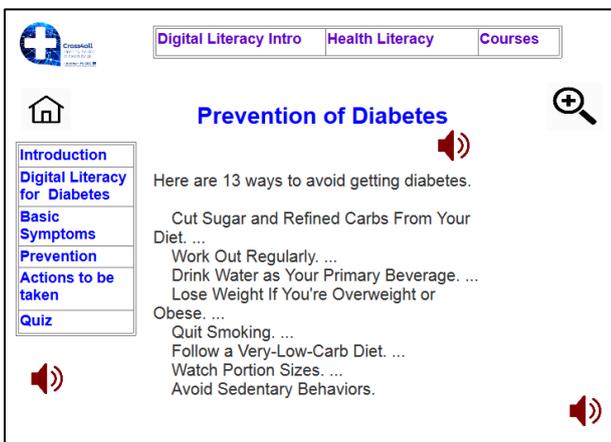


Figure 9. Prevention information page.

There is a very useful page in this e-learning platform which enables the user to gather knowledge about actions

needed to be taken in the case of some disease appearance (Figure 10).

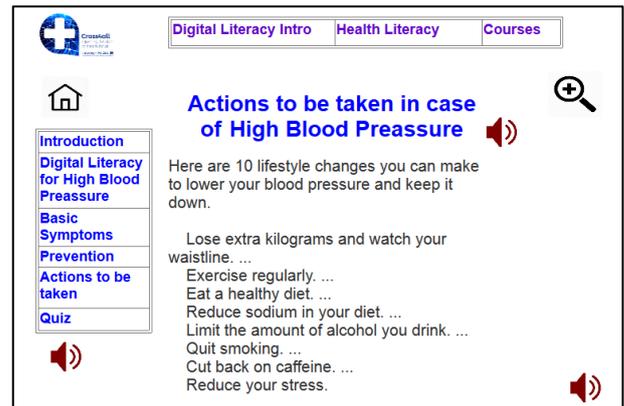


Figure 10. Actions to be taken page.

Taking the quiz for the specific disease will give the user a sense of measuring the level of knowledge regarding that course (Figure 11). It is possible to answer the questions by selecting an answer to each question by simply clicking on the radio button next to each answer.

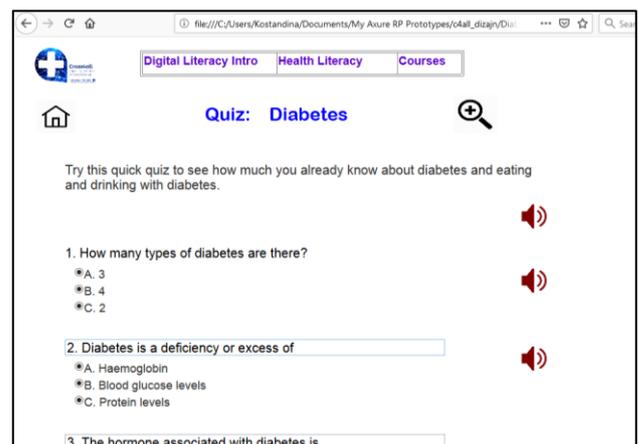


Figure 11. Quiz page

After opening each window, the user has the opportunity to enlarge the content by clicking on the icon “enlarge”, and / or to hear the content, the title, and the menu for that course by clicking on the icon “speaker”.

There is an opportunity to go back on the introduction page of each course by clicking on the icon “home”. Using commonly known icons and words helps the users to easily learn how to use the e-learning platform and work with it without effort which is the key factor in enabling pleasant user experience while using this user interface.

V. CONCLUSION AND FUTURE WORKS

If we consider information architecture as an intersection of users, content and context [10], we can say we succeeded in establishing powerful information architecture that suits the needs of user interface for a digital product for elderly and disabled people. The e-learning platform meets the requirements for the user interface of this group of people and provides accessible tool for broadening their knowledge in specific health issues in a very user-friendly manner. The next step in this digital product creation is to design and produce visual forms in the real e-learning platform and also, to enrich the content by various diseases and for different types of disabilities. We also consider designing an improved e-learning platform that will include intelligent user interface where artificial intelligence techniques [11] could be implemented in order to make the process of learning the health issues for persons with a disability much easier.

ACKNOWLEDGMENT

This research is supported by the EU and North Macedonia within the IPA project CROSS4ALL (Cross-border initiative for integrated health and social services promoting safe ageing, early prevention and independent living for all), IPA 2 – 2014-2020 (Cross4all-CN1-S01.2-SC015).

REFERENCES

- [1] The Right to Education for Persons with Disabilities: Overview of the Measures Supporting the Right to Education for Persons with Disabilities reported on by Member States, United Nations Educational, Scientific and Cultural Organization (UNESCO), Paris, 2015
- [2] Norman, D., The Design of Everyday Things, Basic Books, 2013
- [3] Downey, L., Banerjee, S. Building an Information Architecture Checklist, Journal of Information Architecture, Volume 2, Issue 2, 2010
- [4] Rosenfeld, L. et al. Information Architecture: For the Web and Beyond - 4th Edition, O'Reilly Media, 2015
- [5] Veljanovska, K. User Interface and Human Computer Interaction, Lecture Notes, University St. Kliment Ohridski - Bitola, 2019
- [6] Morville, P., Rosenfeld, L. Information Architecture for the World Wide Web, O'Reilly, 2006
- [7] Stephanie Crawford, How Information Architecture Works, 2011.
- [8] Veljanovska, K. et al. User Interface Design for e-Learning Platform for Digital Health Literacy, Course Project UI and HCI, University "St. Kliment Ohridski", Bitola, 2020
- [9] Veljanovska, K. et al. User Interface for e-learning Platform for Users with Disability, Proceedings of the Information Systems and Grid Technologies 2020, Sofia, 2020, p. 68-81
- [10] Lindberg, O. Information Architecture: The Intersection of Users, Content and Context, <https://xd.adobe.com/ideas/process/information-architecture/information-architecture-users-content-context/>
- [11] Veljanovska, K. Analysis of Machine Learning Algorithms Performance for Real World Concept, Proceedings of International Conference on Intelligent Computing and Technology ICICT'17, Coimbatore, 2017, pp. 656-66

Prof. d-r Kostandina Veljanovska completed her education at the University "Sts. Kiril i Metodi", Skopje (BSc in Computer Science), at the University of Toronto, Toronto (MSc in Applied Engineering) and got her MSc and also her PhD in Technical Sciences at the University "St. Kliment Ohridski", Bitola, R. Macedonia. She has completed postdoc in Artificial Intelligence at the Laboratory of Informatics, Robotics and Microelectronics at the University of Montpellier, Montpellier, France. She worked as a Research assistant at the ITS Centre and Testbed at the Faculty of Applied Science, University of Toronto, Canada. She also, worked at research team for Constraints, Learning and Agents at LIRMM, University of Montpellier. Currently, she works as Full Professor in Information Systems and Networks, Artificial Intelligence and Systems and Data Processing at the Faculty of Information and Communication Technologies, University "St. Kliment Ohridski" - Bitola, Republic of Macedonia. Her research work is focused on artificial intelligence, machine learning techniques, intelligent systems, intelligent user interfaces and human-computer interaction. She has published numerous scientific papers in the area of interest, as well as several monographic items. She is a reviewing referee for well-known publishing house, journals with significant impact factor in science and also, member of editorial board of several international conferences.

How to Cite this Article:

Veljanovska, K. (2020). Information Architecture Analysis for User Interface Design (Case Study: E-learning Platform for Users with Disability). International Journal of Science and Engineering Investigations (IJSEI), 9(106), 23-28. <http://www.ijsei.com/papers/ijsei-910620-05.pdf>

