

Development and Implementation of Web Based Fuzzy Logic Course Content for Distance Education

Abdullah ELEN, Ahmet ALBAYRAK, Raif BAYIR

Abstract— In this study, the development and implementation of web-based content for distance education of fuzzy logic course which is being educated at Karabük University, Institute of Science and Technology, Electronic and Computer Education Department is described. For this, international studies which are related with educational design, human - computer interaction and ways to improve content topics were examined. To provide learning in electronic environment, presenting the content as understandable, supporting with convenience audio-visual materials, configuring by evaluating the specific expression formats and detection processes for people and being in structure that facilitating the learning of learning person's interaction with computer are aimed.

I. INTRODUCTION

FOR better understanding of distance education we need to make the definition of distance education. Encountering many descriptions in the literature about distance education is possible. In California Distance Learning Project, the definition is that distance education is an interactive training system that implemented by establishing a connection between educational resources and student. At this information age, fundamental changes related to education are can be summarized as follows:

- Learning needs are rapidly increasing and diversifying and becoming a service that will be used and requested during the entire life of individuals.
- Learners are requesting more flexible, engaging, individualized and easy learning formats.
- With quick information transmission and knowledge access capacity, new information technologies allows the development of more efficient and non-formal education models.

All of the use of technology in the field of education is "electronic learning" for short is known as e-learning. E-learning implementations which are in general takes place under the umbrella of distance education and take advantage of many education technology and media are start to

pervading rapidly. This study describes that how the distance education application of fuzzy logic course is performed.

II. WEB BASED EDUCATION

Web based education, to create a meaningful learning environment that in education promoted and supported, is a hypermedia based education program that uses resources on WWW [1].

Web, since 1991, is recognized on the Internet is greatly enhanced. Mosaic browser in 1993, has emerged. WWW in 1994 has become the second most popular service on the Internet by passing Telnet. In 1995, the Web through file transfer protocol services has become the most popular on the web. At the same time, CompuServe, America Online, Prodigy, such as commercial e-mail providers have begun to provide Internet access. While there were 376000 server computer at January 1991, this number has grow up to 9 472 000 in January 1996. While there were 3556 network at January 1991, this number has grow up to 93 671 in January 1996. In 1995 internet was covering 173 of 238 areas in the world. This means that until 1995 % 73 of world nations were connecting to internet. Internet community that by Vinton Cerf in 1992 has made great contributions to ensure use of established standard protocols. As result of efforts of internet community internet concept has integrated with global village concept. Cerf estimated that until 2000 year 200 million computers would be over internet. At the moment this numbers are exceeded [2].

Internet can be seen as a platform that a number of services presented in when handled from users angle. In each internet service there is a center that presents this service and a large number of clients that benefit from this service. Internet services can be grouped in two groups as access to information services and communication services [3].

A. Access to Information Services

Information access services are held to find content on the Internet environment and to bring this content to the user's computer. These services are mainly WWW, FTP and search engines.

WWW: WWW in the beginning has developed to access web pages and edit content that scattered to many pages and linked to each other in top text format, but in time has come to the level that in can use files whose format is sound, video or moving image not text. WWW is the most rapidly developing between the services over the Internet because it makes files that over internet easily accessible with the help of scanners. Pages which in WWW are created with HTML

Abdullah ELEN, Karabük Üniversitesi Teknik Eğitim Fakültesi, Elektronik ve Bilgisayar Eğitimi Bölümü. Balıklar kayası kampusu, 78050, Yüzüncü yıl, Karabük TR aelen@karabuk.edu.tr

Ahmet ALBAYRAK, Karabük Üniversitesi Teknik Eğitim Fakültesi, Elektronik ve Bilgisayar Eğitimi Bölümü. Balıklar kayası kampusu, 78050, Yüzüncü yıl, Karabük TR aalbayrak@karabuk.edu.tr

Raif BAYIR, Karabük Üniversitesi Teknik Eğitim Fakültesi, Elektronik ve Bilgisayar Eğitimi Bölümü. Balıklar kayası kampusu, 78050, Yüzüncü yıl, Karabük TR rbayir@karaelmas.edu.tr

(Hypertext Markup Language). Today, many users have created their own HTML page with an HTML editor and publish on the Internet by placing that on the network server.

FTP: With FTP (file transfer protocol) as one of the first developed Internet services users can transfer files that in FTP servers to their own computers. In FTP servers there are free software, books whose distribution is free and multimedia files. From servers which open to the public people who wish can download these files. Usually not possible to publish directly through the WWW DOS and Windows-based traditional education software's distribution can be implemented as more suitable.

Search Engine: The increasing amount of information very quickly over the Internet in a manner creates information pollution. Users find what they're looking for a file on the internet is becoming increasingly difficult. Search engines are systems that ensure Access to files that related to keywords of researchers who make research about a particular topic. Today the most used search engines are Yahoo and Alta Vista. In Yahoo, information has been classified as very detailed previously. Users can select topics related to access files that are sub-titles. In Alta Vista, by making word entrance about investigated issue, all files that in research word is passed and indexed by Alta Vista are accessed.

B. Communication Services

A section on Internet services were developed to provide information flow between users. The main communication services can be given as electronic mail, discussion groups, chat channels and video-conferencing.

Electronic Mail: Electronic mail services are systems that are used to send messages or files to other computer user's electronic mail addresses over computer networks. Electronic mail software ensures to users communicate with the four corners of the world by giving a variety of services as messages read, store, send, reply and queue.

Discussion Groups: Discussion groups are systems which work similar to the electronic billboards. Users leave their messages, questions and advertisements to group which they are members of between thousands of interest groups and makes discussions about their opinions with the same group members. There are groups that without manager and anyone who want to join can join also there are groups that have a manager and open to certain groups.

Chat Channels: Instant messaging service servers allow users bound to it to chat with each other in writing by keyboard. Users can join chat channels on the server or it can create channels. Unwanted users can be removed from the channel, desired users can be invited, channels can be combined and the channel can be divided. Chat channels are used to create a community on the Internet is one of the most powerful applications.

Video Conference: Opposing two users provide a lively conversation by transferring image and audio that recorded with the help of a small camera and microphone installed on the screen using video conferencing software. Opposing to

one to one use and full screen image transfer properties of professional video conferencing systems, at this lower cost and using software such as NetMeeting video conferencing system the transferred image can be monitored from one-eighth the size of a window. At the time that bandwidth is sufficient small chat groups that more than one person can communicate with audio and image can be created.

III. DISTANCE EDUCATION

Distance education is an educational delivery system that connects people who will learn with the resources of the training. Distance education provides educational access to people that not enrolled in formal education and an increase at students' learning opportunities. Distance education applications are progresses that use current resources and continuously advancing by combining developing technologies [4].

Distance education is making the education reached to remote students with the help of electronic tools such as satellite, video, audio, graphics, computer, multimedia technology. Teachers and students are at the distance from each other geographically and in that training programs or written materials and printed materials should be used. Distance education is consists of two basic parts that are students into the field education and are teachers into the field education [5]. One of the major benefits of distance education is enables monitoring experiments that have high costs and risks. If necessary, participants can start the experiment, receive real-time data about the experiment and can repeat tests as many times as they want. At the same time, experiments' repeats can be reduced thanks to multiple users' monitoring the experiments over internet. This also provides economic contributes [6].

Needs to be done things for creating a real classroom environment over internet are variously. Distance education activities with audio and video;

- a) Teachers can make simultaneously calls with one or more student that selected and these students can join to call as interactive.
- b) Teachers can make live appeal in whole class.
- c) A student can make live calls with one or more student.
- d) Multimedia content in the archive can be monitored or recorded according to identified permissions.

It is important that these activities can be done without interruption. As an example, teachers should be allowed to direct broadcast to a video in the archive with the push of a button when students watching him. A momentary interruption occurred in the broadcast during this process may cause stop in broadcast at viewer side. For carrying out this process without problems different techniques can be applied [7].



Fig. 2. Login Screen

According to Holmberg there are seven basic units for distance education [8]:

1. A personal relationship environment should be between teaching and learning groups.
2. Good developed self-teaching materials should be obtained.
3. Place should be given to the intellectual pleasures at experiments.
4. The atmosphere, language and agreements must be made with a friendly conversation.
5. Received / sent messages by teacher should be interactive, easy to understand and remember.
6. We always need to have an interactive approach to distance education.
7. For a organize study, planning and guidance is required.

IV. FUZZY LOGIC

Fuzzy systems are alternative ideas to the origin of the ancient Greek philosophy and logic which is based on the classic set membership. Known mathematical models are indebted their success that in large areas to Aristotle and other thinkers who has come before. These thinkers were fundamentally designed logic theory and referred it to as laws of thought. Logic studies, in 1965, have begun with Dr. Lotfi Zadeh's "Fuzzy Sets" article that published at "Information and Control" magazine [9].

Fuzzy logic with logical applications in a similar way to human behavior is logic of computer revolution that helps to computers. The use of fuzzy logic in the industry improves productivity, provides a more appropriate production, bring economic benefits today that in time is very important. As

one of many application areas in control engineering, controllers that designed using fuzzy logic generally used at systems whose mathematical models could be derived hardly and which not give productive results when controlled with known methods. To understand fuzzy logic in a simple concept when we look at sentences such as 'a little hot', 'almost true', 'very fast', these sentences not express a situation in terms of mathematic, but it can be seen that this sentences in terms of solving a problem often encountered and used in daily life. Fuzzy logic allows the systems and devices to operation as in shape that a people can understand reach to the solution. As words meaning, Fuzzy Logic seems to contain an uncertain situation but in mathematical applications is very useful [10].

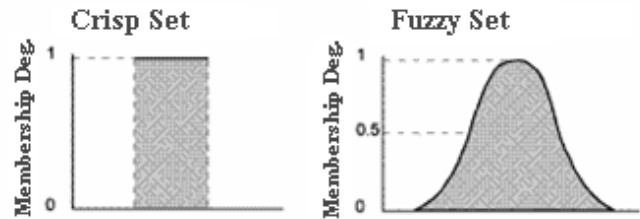


Fig. 1. Membership functions of traditional and fuzzy sets.

The most basic difference between traditionally and fuzzy sets is the membership function. Values that membership functions of traditional and fuzzy sets can take are shown at figure 1. As it can be understood from examination of fig. 1, a traditional set can be characterized with only one membership function but as theoretically a fuzzy set can be characterized with infinite number of membership functions.



Fig. 3. Main Page

The basis of fuzzy set theory is that determination of membership functions overlapping with application in a right way. Therefore, membership functions are determined once and then, anything that is fuzzy in the fuzzy sets theory is said to be.

For the operation of a system or an object, "how much" or "after which point" with the answers to questions such as membership functions of fuzzy sets are attempting to create. Process to determine membership function of a fuzzy set can be as intuitive based on concepts practical meaning.

Fuzzy logic provides the basis advantages are listed below [11, 12].

1. Close to the people thinking systems and style.
2. Does not necessarily need a mathematical model in application.
3. Because of the simple software, the system can be established as more economical.
4. It is easy to understand the concept of Fuzzy Logic.
5. Through the use of membership values, according to other control techniques is more flexible.
6. Use of information that is not certainty.
7. Could allow to model non-linear functions.
8. Only by benefiting from the experience of professionals, easily a model or system based on fuzzy logic can be designed.
9. It is in a state of harmony with Traditional control techniques.
10. With the use of the verbal expressions of human communication in fuzzy logic more positive results emerged.

V. WEB BASED FUZZY LOGIC EDUCATION

In this study, a web based automation that has simple and specific structure and suitable to distance education standards of fuzzy logic course which is being educated at Karabük University, Institute of Science and Technology, Electronic and Computer Education Department, is developed. Major issues related to the topic of fuzzy logic participated in content. Moreover, to make matters more understandable and to make more interactive various applications works with C# programming language on ASP.NET 3.5 platform, online chat, and online courses are available for monitoring.

The prepared distance education application's structure consists of three parts by keeping in mind that the adopted training methods.

1. To give students information about the theoretical
2. Students can grasp the subject fully exercises, case studies and implementation of tests.
3. Examination of students, projects and assignments are delivered to individual web pages.

Students from the login screen as shown in Figure 2 can log into system in a controlled manner with the help of student number and password. At the same time, the system can be protected from possible attack by the security tag has been prepared.

3. KLASİK VE BULANIK İLİŞKİLER

Max-Min Composition

$A \times B =$

	Y1	Y2	Y3	Y4
X1	0,18	0,12	0,08	0,04
X2	0,45	0,30	0,20	0,10
X3	0,81	0,54	0,36	0,18
X4	0,27	0,18	0,12	0,06

$B \times C =$

	Z1	Z2	Z3	Z4
Y1	0,36	0,09	0,54	0,27
Y2	0,24	0,06	0,36	0,18
Y3	0,16	0,04	0,24	0,12
Y4	0,08	0,02	0,12	0,06

$I =$

	Z1	Z2	Z3	Z4
X1	0,18	0,09	0,18	0,18
X2	0,36	0,09	0,45	0,27
X3	0,36	0,09	0,54	0,27
X4	0,27	0,09	0,27	0,27

$R = A \times B \quad \text{ve} \quad S = B \times C$

$\tilde{I} = R \circ S$

$\tilde{I} = \{(x,z) \max\{\min(\mu_R(x,y), \mu_S(y,z))\}$

$x \in X, y \in Y, z \in Z$

$\mu_{\tilde{I}}(x1, z1) = 0,18$	$\mu_{\tilde{I}}(x3, z2) = 0,09$
$\mu_{\tilde{I}}(x1, z2) = 0,09$	$\mu_{\tilde{I}}(x3, z3) = 0,54$
$\mu_{\tilde{I}}(x1, z3) = 0,18$	$\mu_{\tilde{I}}(x3, z4) = 0,27$
$\mu_{\tilde{I}}(x1, z4) = 0,18$	$\mu_{\tilde{I}}(x4, z1) = 0,27$
$\mu_{\tilde{I}}(x2, z1) = 0,36$	$\mu_{\tilde{I}}(x4, z2) = 0,09$
$\mu_{\tilde{I}}(x2, z2) = 0,09$	$\mu_{\tilde{I}}(x4, z3) = 0,27$
$\mu_{\tilde{I}}(x2, z3) = 0,45$	$\mu_{\tilde{I}}(x4, z4) = 0,27$
$\mu_{\tilde{I}}(x2, z4) = 0,27$	
$\mu_{\tilde{I}}(x3, z1) = 0,36$	

$$R = A \times B \text{ ve } S = B \times C$$

$$I = R \circ S$$

$$I = \{(x,z) \max\{\min\{\mu_R(x,y), \mu_S(y,z)\}\}\}$$

$$x \in X, y \in Y, z \in Z$$

$$\begin{aligned} \mu_I(x1, z1) &= 0,18 & \mu_I(x3, z2) &= 0,09 \\ \mu_I(x1, z2) &= 0,09 & \mu_I(x3, z3) &= 0,54 \\ \mu_I(x1, z3) &= 0,18 & \mu_I(x3, z4) &= 0,27 \\ \mu_I(x1, z4) &= 0,18 & \mu_I(x4, z1) &= 0,27 \\ \mu_I(x2, z1) &= 0,36 & \mu_I(x4, z2) &= 0,09 \\ \mu_I(x2, z2) &= 0,09 & \mu_I(x4, z3) &= 0,27 \\ \mu_I(x2, z3) &= 0,45 & \mu_I(x4, z4) &= 0,27 \\ \mu_I(x2, z4) &= 0,27 & & \\ \mu_I(x3, z1) &= 0,36 & & \end{aligned}$$

İlişki Türü: ☒ Klasik ☐ Bulanık

Birleşimler: ☒ Max-Min ☐ Max-Product

A Kümesi

0,2
0,5
0,9
0,3

Ekle Çıkar

B Kümesi

0,9
0,6
0,4
0,2

Ekle Çıkar

C Kümesi

0,4
0,1
0,6
0,3

Ekle Çıkar

Eklediğiniz elemanı listeden çıkarmak için önce listeden elemanı seçin ve ardından [Çıkar] butonuna tıklayın.

UYGULA

Fig 4. Application screen (Crisp and Fuzzy Relations)

IP address and date information of all users who log into the distance education automation are stored with security objectives.

Students login the system, as seen in Figure 3, reached into their own main page. At this page, topic explanations, video conferencing, sample applications, online test, course program, student profile and modules that in participants can share information with each other are available. Students effectively use learning objects to be a simple structure and easy to use home design has been done.

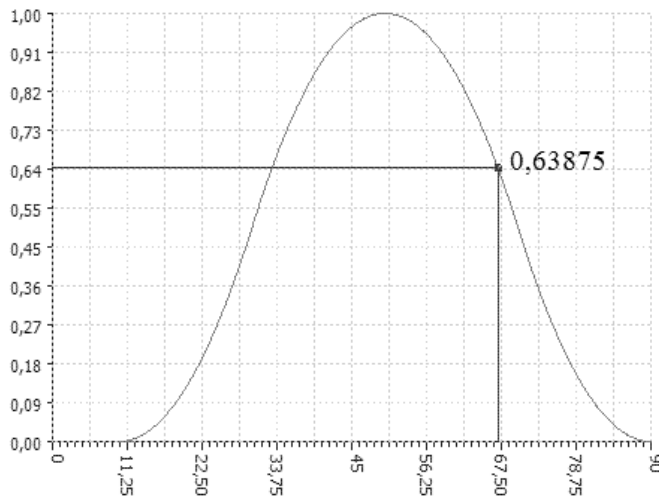
A. Topics of Expression and Applied Education Page

It is important that teaching web pages should be convenient to design principles and include interactive multi-media applications for obtaining a high percentage of learning about subjects. Educational web sites that supported by multimedia applications includes small audio and video files that played with the help of special applications.

There are three interactions in distance education format: Learner-teacher, learner-learner and learner-content.

4. ÜYELİK FONKSİYONLARI

PI Üyelik Fonksiyonu



X: 67

B: 40

C: 50

UYGULA

Açıklama

A: başlangıç noktası.

B: kırılma noktası.

C: tepe noktası.

X: 0-1 arası optimizasyon değerinin hesaplamasında kullanılan ölçümdür.

Üçgen MF | Yamuk MF | PI MF | S MF | Gaussian MF

Fig 5. Application screen (Membership Functions)



Fig 6. Video conference screen

Learner-teacher interaction; teacher presentation, the narrative, the feedback, and in providing help to students is in the form of a teaching format. Learner can enter into the interaction by asking the question, giving homework and discussing problems with teachers. Learner-content also is main component of the interaction. Content can be found in books, the surrounding objects, abstract ideas, the videotape, computer programs, Web sites. In learner-learner interaction students can rate their projects by themselves, discuss, share ideas and help each other [13].

In automation system, Fuzzy Logic course topics are reinforcing with sample applications (fig. 7) by sharing them with students in an interactive way. As real-time or asynchronous, students are able to get help from multi-media fields. In discussion fields students asks questions to teacher about fields, thus education will become more efficient. In this way, missing or wrong learning prevented. Students in a way that based on cooperation with these multi-media provide contributions to the information between them.



Fig. 7. Fuzzy Logic sample applications.

Lecture notes and the newly opened page is enriched with application examples. Online course on the subject of the exercises can be done at work. Teaching staff on the process that will provide additional resources if necessary. Additional resources added to the course work can be seen by students by topic.

ASP.Net platform for students to benefit from the powerful architecture of the pages are designed and applied to do the exercises. The sample application in Figure 4 Crisp and Fuzzy Relations is aimed to reinforce what is learned about. Performed about the application mentioned as containing all the applications are intended to provide the learning permanent. Students also given about the homework and projects need to check this page may resolve to experiment with.

Membership functions screen seen in figure 5 is prepared for consolidating learned content. In these content students learns membership function which is one of the basic of fuzzy logic. As seen in the figure students can control their computing by using this so easy to use and simple screen. According to selected membership function, it is created some textbox, the crisp values which are entered to these textbox are converting to fuzzy values by pressing **UYGULA** button. As membership function the most preferred ones triangle, trapezoid, pi, sigmoid and Gaussian can be applied.

Video conference which is popular related to improvement in internet is very important service to reduce education costs and it supply lecturer to communicate with student without sharing same class. Distance education is summarized as a

transition from one side education and without communication or delayed communication to two side education and synchronous education. It started a new dimension in distance education by using computers, computer networks and especially internet in two side and synchronous education. In this application lecturers can enter system and teach their lesson and also ask question to the students.

There are many different ways to form a real class atmosphere in internet. In this study prepared voice and video applications are enumerated as items at the below.

- a) The lecturer can select one or more students and communicate with them at the same time,
- b) The lecturer can address the entire student,
- c) One student can communicate with another or others,
- d) Student can watch and save multimedia content in archives according to determined permission.

Lecturers and students can communicate with each other in high level via video conference screen seen in figure 6. The study which is prepared for master does not need very much internet speed because there are a few students in the class. Students can communicate with lecturer by chatting privately or talking to each other as if all the students are in the same class at the same time. If the lecturer gives permission the video content can be saved. Also if the lecturer gives permission student can use this video content.

Students have their private pages to get used to distance education. These pages supply students to learn lesson grade, read input message and share knowledge each other. Students also deliver their homework and project to lecturer via this page.

Lecturer prepares some questions connected with subject to test student's understanding. Lecturer determined the time of test. This test gives very important back-feeding and used to plan the education period and to evaluate education period.

VI. CONCLUSION

Now, the big improvements in the technology effect to education and it becomes necessary to arrange education system again. Using computer and internet increases learning styles and types [14]. Communication and education is the most effected field from technologic improvements [15]. In this study it is realized to teach fuzzy logic lesson on internet by remote education. It is applied to master degree students and according to increase of internet speed it can be applied to undergraduate education or other education systems.

REFERENCES

- [1] Bay, Ö.F., Tüzün, H., "Yüksek Öğretim Kurumlarında Ders İçeriğinin Web Tabanlı Olarak Aktarılması-I", Journal of Polytechnic, vol: 5, No: 1, 2002, pp. 13-22.
- [2] Cerf, V. G., 1996, On The Internet, 2 (2), 37.
- [3] Çetinöz, N., Mutlu M.E., Seniş, B.F. İnternet Tabanlı Eğitim Uygulamalarında Öğretmenin Sahip Olduğu İzleme Araçlarının Açıköğretim Sisteminde Uygulanabilirliği BTİE'99 Bilişim Teknolojileri Işığında Eğitim 1999 (13-15 Mayıs 1999), ODTÜ Kültür ve Kongre Merkezi.
- [4] Adult Learning Activities World Wide Web site, <http://www.cdlponline.org/index.cfm?fuseaction=whatis> , California Distance Learning Project (CDLP).
- [5] http://www.usdla.org/04_research_info.html
- [6] Elen, A., Bayır, R. "Bilgisayar Destekli Otomotiv Test Standının İnternet Üzerinden Uzaktan Eğitim Amaçlı Kullanımı İçin Kullanıcı Arayüzü Yazılım Tasarımı", 5. International Advanced Technologies Symposium (IATS), Karabük Üniversitesi, Karabük, Türkiye, 13-15 Mayıs, 2009.
- [7] Gezer, A. ve Koçer, S. "Uzaktan Eğitimde Sesli ve Görüntülü Yayınların İnternet Üzerinden Aktarılması", Gazi Üniversitesi. Bilişim Teknolojileri Dergisi, Mayıs 2008.
- [8] Holmberg, B., "The Concept, Basic Character and Development Potentials of Distance Education", Distance Education, vol: 10, No: 1, 1989, pp. 127-135.
- [9] Ross, T. J., "Fuzzy Logic with Engineering Applications", London, 1995.
- [10] Çiftçi H., "Fuzzy Logic Approximation For Some Mathematical Functions", OGU Lisans Tezi, Eskişehir, 2002.
- [11] www.ta-eng.com/industry/mforum/fuzzy/preface.htm (08.08.2002).
- [12] Şen Z., "Bulanık (Fuzzy) Mantık Ve Modelleme İlkeleri", Bilge Sanat Yapım Yayınevi, İstanbul, 2001.
- [13] Özarslan, M., Kubat, B., Bay Ö.F., "Uzaktan eğitim için entegre ofis dersinin web tabanlı içeriğinin geliştirilmesi ve üretilmesi", Akademik Bilişim 2007, 31 Ocak-2 Şubat, Dumlupınar Üniversitesi, Kütahya, 2007.
- [14] H.Ünsal, "Web Destekli Eğitim, Elektronik Öğrenme ve Web Destekli Öğretim Programlarındaki Çeşitli Ders Modelleri", Türk Eğitim Bilimleri Dergisi, Cilt, 2 sayı, 3 s. 375-388, 2004
- [15] G. Ekici, "Uzaktan Eğitim Ortamlarının Seçiminde Öğrencilerin Öğrenme Stilllerinin Önemi", Hacettepe Üniversitesi, Eğitim Fakültesi Dergisi, Sayı 24, s. 48-55, 2003.