Fuzzy model for evaluation of selected Diabetes Medical Sites

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Abstract

The aim of this paper is to give model to evaluate Diabetes Medical Sites (DMSs) quality by fuzzy system to arrange these sites according to their quality depending on the values that get it during the application of the model on these sites. This model contain the most important element suggested for quality criteria like the Design Site, Update Site, Hyperlinks, Ability of User, Insufficient, Information, Use of visual effects, Data on the sources, time Input, Consistency content with goals of site. The particular goals of this work were to identify criteria for the evaluation of DMSs such as legitimacy; dependability, and usefulness and find out the weakness of those sites. The particular goals of this work were to identify criteria for the evaluation of DMSs, reconnoiter; usability of recognize criteria for the evaluation of DMSs with the identified criteria for the corroboration; of legitimacy; dependability, and usefulness; and find out the weakness of those sites. Additional, we give propositions; for improving the usability, content quality, dependability, performances and some other elements that must took care when evaluating sites and documentation information can use it in scientific research.

1-Introduction

Diabetes is a very common disease nowadays among the people of all age groups and has become a major health problem. Diabetes can be classified into four clinical types [1-3]:

- Type 1 diabetes due to β-cell obliteration, usually leading to absolute insulin insufficiency.
- Type 2 diabetes due to enlightened insulin; secretory defect on the contextual of insulin opposition.
- Other specific types of diabetes due to other causes, such as genetic defects in β-cell function.

- Genetic Defects in insulin action, diseases of the exocrine pancreas.
- Gestational Diabetes Mellitus (GDM) diagnosed during pregnancy that is not clearly overt diabetes.

With the rise in cases of diabetic patients there is a need of a reliable and accurate system that can diagnose the diabetes with a great accuracy at its early stage. The medical diagnosis of disease involves the patterns of observable symptoms and the result of diagnosis reports of test. But various costs and risks are associated with these tests. Various techniques;; such as artificial intelligence, fuzzy inference mechanisms and fuzzy expert, biomedical engineering, evolutionary algorithms and different systems have been proposed by the researchers for diagnosing and treating diabetes. But the accuracy and; productivity of the prediction of diabetes is not so momentous. All the developed expert systems aimed to diagnose the diabetes based on some parameters but there are some other parameters that had not been discussed so far. The aim of our paper differs from previous research, we will not address to the diagnosis and prediction of emerging diabetes, but to evaluate the international and Arab specialized sites diabetes, which is providing regulation to patients, such as the quantity and quality of food and the types of medicines used and the types of sports practiced, based on standardized evaluation criteria [4-5].

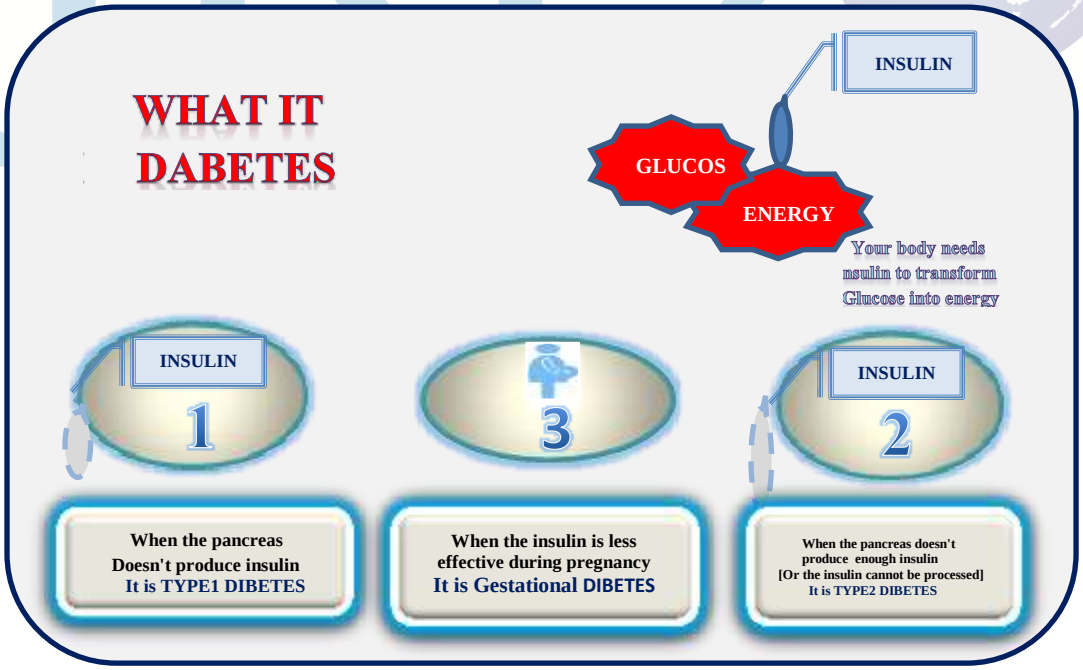


Figure (1): classification of Diabetes.

(2)

The paper consists of seven sections, first section explain the introduction of our paper, in the second section the proposed Diabetes Medical Sites are wanted to evaluate**,** third section, forth section discusses, fifth section shows the experimental results and the fuzzy rules used in the system, finally seventh section describes the conclusion and the last section of our paper shows the references which we have taken for this paper.

2- The proposed Diabetes Medical Sites to Evaluate

Several evaluation methods have been proposed to evaluate the usability of Diabetes Medical Sites to suggest improvements in the design of sites. Any site can be evaluated and determined by using evaluation methods and techniques. Generally, any site should meet the needs of its various users the users of site are mainly worried with the following two main queries:

- Is the wanted information being institute easily in site?
- Is the information being institute in well-timed manner?

in this paper we recounted is envisioned to point out the strength and weakness of the usability facets in the design of Diabetes Medical Sites , counting Design Site, Update Site, Hyperlinks, Ability of User, Insufficient information, Update Site, Use of visual effects, Data on the sources, Time Input and Consistency content. Diabetes Medical Sites that have been evaluated in our proposed system are shown in the figure (2) and their websites, we choose (12) international and Arabic Diabetes Medical Sites from hundred international and Arabic medical sites.

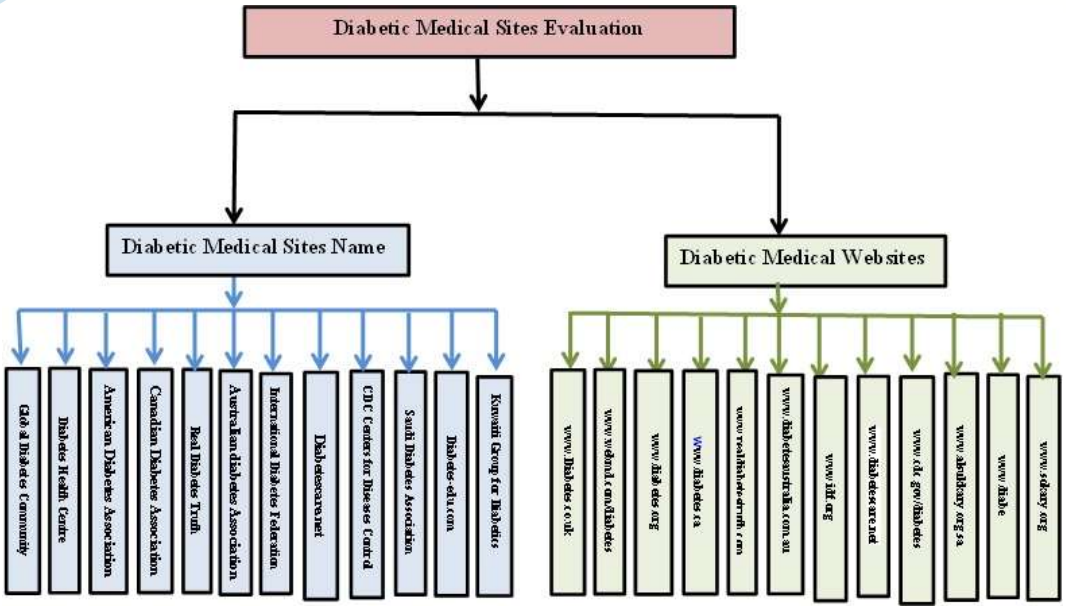


Figure (2): The proposed Diabetes Medical Sites to Evaluate.

(3)

3- Criteria of the evaluation

The criteria used in our paper explained in the figure (3) below which are used for (12) international and Arabic Diabetes Medical Sites such as Design Site, Update Site, Hyperlinks, Ability of User, Insufficient, Information, Update Site:, Use of visual effects:, Data on the sources, time Input, Consistency content with goals of site which are the most prominent criteria that can help researchers to measure the degree of confidence and believability in the sources of information available on the internet and To find out more widely used sites on the part of people with diabetes in the world [6-8].

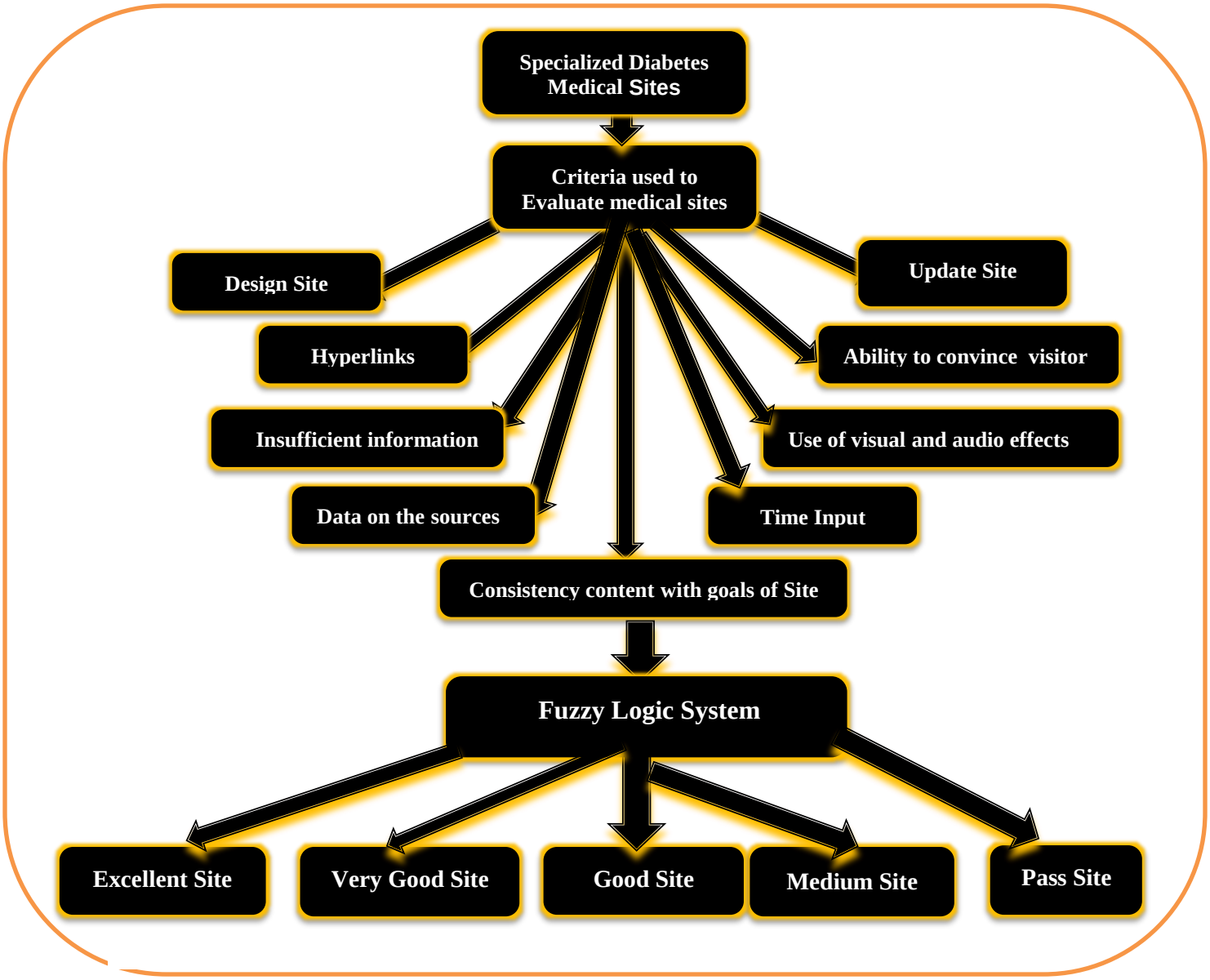


Figure (3): Hierarchical representation to evaluate Diabetes Medical Sites.

(4)

The opinions on criteria for Diabetes Medical Site are used in our paper such as Design Site,Update Site, Hyperlinks,Ability of User, Insufficient information, Use of visual and audio effects , Data on the sources, Time Input,Consistency content with goals of site explained in the following tables(1,2,3,4,5,6,7,8,9).

	Opinions of design site criteria
1	Convenient design site with the required type of service
2	Explanation of how roaming pages Site
3	Available visual qualities in the design site
4	Colors used in the design consistent and non-overlapping fonts
5	Characterized by gravity to use innovative and imaginative methods

Table (1): Opinions of design site criteria.

	Opinions of Update Site Criteria
1	Modern site information and declares all of the new books and Services
2	Appearance date of the last update for the site in its pages
3	Modern site link
4	Periods of updating the site notes when roaming through the specified intervals
5	Provides a Really Simple Syndication Service(RSS)

Table (2): opinions of Update site Criteria.

	Opinions of Ability of User Criteria
1	Simplicity to use and understand and deal with the site by any user
2	Easy access to the information required by any user regardless of scientific background
3	Possibility of adding any new information by the user of the site
4	Preserves the site on the user's personal information
5	Provides services to the user such as his e-mail, chat and search by most common languages

Table (3): Opinions of Ability of user Criteria.

	Opinions of Hyperlinks Criteria
1	Existence communication tools and feedback between the user and the site through e-mail or chat
2	Site contain external links to other sites in the same subject
3	Presence assistant links on each page so make easier for the user to move to main page through any other page
4	Available multi-media and interactive on site
5	Colors and fonts used consistency in the site, making it easier to read its contents

Table (4): Opinions of Hyperlinks of user Criteria.

	Opinions of Insufficient information Criteria
1	Site information printed free of spelling errors and language
2	Site information free of advertising of all kinds
3	Appropriate site information with all users browsing this site
4	Site information variety and non- possession of a particular topic
5	Existence clear instructions on how to use the site, but only the main menu sufficiency

Table (5): Opinions of Insufficient information of user Criteria

(5)

	Opinions of Use of visual and audio effects Criteria
1	Provides a visible and clear instructions for using site
2	Existence communication between users and the site through e-mail and chat
3	Use certain software to view the entire contents of the sit
4	Existence alerting messages to help users when an error occurs
5	Provides answers to repeated questions on the site

Table (6): Opinions of visual and audio effects of user Criteria

	Opinions of Data on the sources Criteria
1	Existence information on the functional status of the charge of the site
2	Existence e-mail for the charge of the site
3	Available Scale for the credibility and reliability of information
4	Site information is not excerpted and dependable
5	Site features and easily get access to information through the main list

Table (7): Opinions of Data on the sources

	Opinions of Time Input Criteria
1	Speed download site when entering it
2	Site contains a least number of advertising to avoid loading pages long time when enter it
3	Speed access to the site by one well-known search engines(Yahoo ,Google,..)
4	Speed access to the required information
5	Browsing within the site does not require a long time when entering it

Table (8): Opinions of Time Input Criteria

	Opinions of Consistency content with goals of site Criteria
1	Clarity target site being scientific, business, entertainment, education, news, personal
2	Consistency of the site title with a site and the nature and easily remembered by the user
3	Site provides all the necessary software to view the site in addition to the ease of uploading
4	Contain the location on a small number of advertising and thus no need for long periods of load
5	Presence of counter to see how many users of the site

Table (9): Opinions of Consistency content with goals of site Criteria

4. Proposed System

The proposed system consists of input variables to cover the ruling to describe and evaluate the Diabetes Medical Sites through a single criteria inputs included: Design Site, Update Site, Hyperlinks, Ability of User, Insufficient, Information, Update Site:, Use of visual effects:,Data on the sources, time Input,Consistency content with goals of site. Input data will be numerical values and we consider this data is the real values of the standards or inputs of fuzzy system, where this system includes 12 medical site and criteria for all nine criteria site. As the director represents the judgment to assess the level of the site and its ability to influence and achieve the set his goals. And here was the adoption of the five reviewers of the 12 sites we have included five of which are shown in the tables in section of experimental results.

4.1. Fuzzy Logic System (FLS)

FLS consists of three main stages, in figure (4) fuzzy Logic System is shown these stages and explains the job of every stage [9-10]:

- Fuzzification converts the crisp values into fuzzy values.
- Fuzzy Inference System (FIS) The main job of fuzzy inference system is decision making based on IF-THEN rules. Along with IF-THEN rules FIS uses "AND" or "OR" connectors for making necessary decisions Rule Base contains a number of fuzzy IF-THEN rules. Database defines the various membership functions of fuzzy sets used in fuzzy rules. There are mainly two types of FIS first type Mamdani FIS and the second type . Sugeno FIS , our paper uses the Mamdani inference system due to its simplicity and its widespread acceptance. It is also well-suited for human input. In Mamdani model fuzzy rules are formed using IF-THEN statements and AND/OR connectives.
- Defuzzification converts the fuzzy values into crisp values as a result.

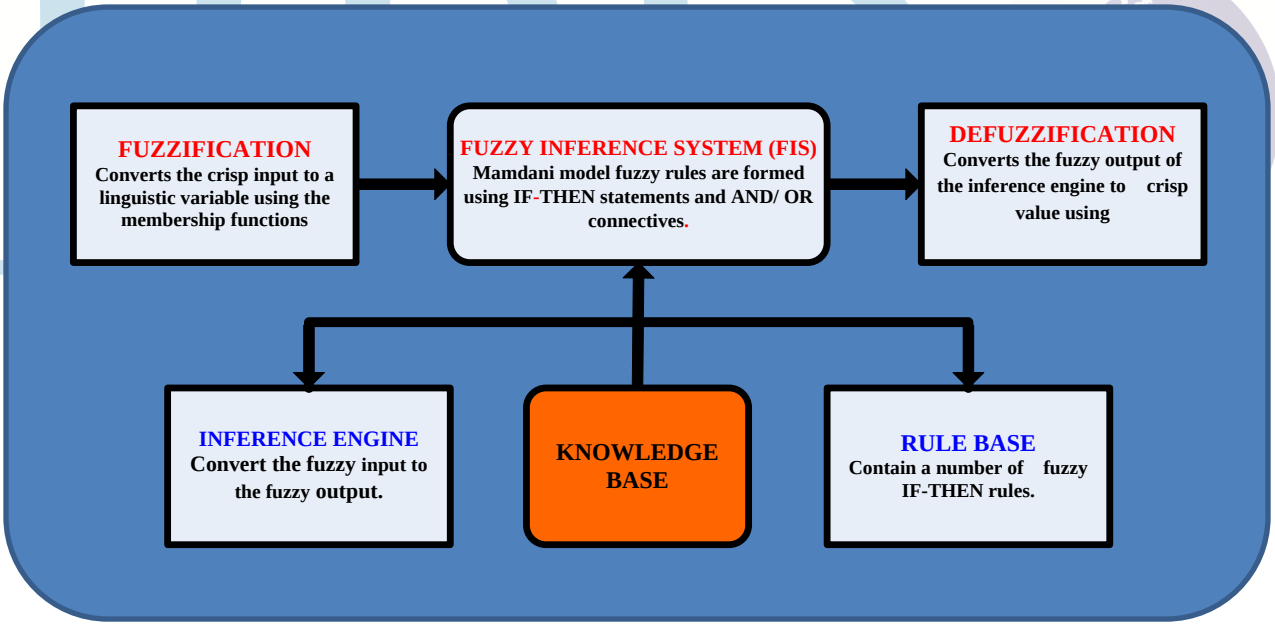


Figure (4): Fuzzy Logic System (FLS) stages

(7)

5. Experimental and Results:

The proposed Fuzzy model for evaluation of selected Diabetes Medical Sites was implemented with the MATLAB, proposed Fuzzy model consist of input for describe and evaluate selected Diabetes Medical Sites by a single criteria included inputs: Design Site, Update Site, Hyperlinks, Ability of User, Insufficient, Information, Update Site:, Use of visual effects:, Data on the sources, time Input, Consistency content with goals of site. Input data which explain in table (10), these input variables or criteria are crisp values of proposed fuzzy model which consist 12 Diabetes Medical Sites, every site has 9 criteria, the output of proposed fuzzy model represent the evaluation of the sites ability effects and implement the goal of it, in our proposed fuzzy model depend on 30 reviewers for 12 Diabetes Medical Sites ,below tables (11,12,13,14,15) explain the evaluation of 5 arbitrary chosen reviewers.

	Input	Class	Level Membership Function				
1	Design Site	Input	Pass	Medium	Good	Very Good	Excellent
2	Update Site	Input	Pass	Medium	Good	Very Good	Excellent
3	Hyperlinks	Input	Pass	Medium	Good	Very Good	Excellent
4	Ability of User	Input	Pass	Medium	Good	Very Good	Excellent
5	Insufficient information	Input	Pass	Medium	Good	Very Good	Excellent
6	Use of visual and audio effects	Input	Pass	Medium	Good	Very Good	Excellent
7	Data on the sources	Input	Pass	Medium	Good	Very Good	Excellent
8	Time Input	Input	Pass	Medium	Good	Very Good	Excellent
9	Consistency content with goals of site	Input	Pass	Medium	Good	Very Good	Excellent
10	Evaluation	output	Pass	Medium	Good	Very Good	Excellent

Table (10): Input data.

	Site name	Criteria									Evaluation
		Design Site	Update Site	Hyperlinks	Ability to convince visitor	Insufficient information	Use of visual effects	Data on the Resource	Time input	Consistency content	
First reviewer	Global Diabetes Community	98	95	94	94	92	90	92	2.5	97	89.04
	Diabetes Health Centre	95	93	93	89	92	92	89	6	86	87.54
	American Diabetes Association	96	98	89	92	95	89	89	6.7	94	86.28
	Canadian Diabetes Association	88	89	88	88	94	90	94	9	87	85.78
	Real Diabetes Truth	89	87	93	88	89	86	89	8.9	83	84.72
	Australian diabetes association	87	85	94	89	87	86	88	10	88	82.32
	International Diabetes Federation	96	87	86	88	83	85	89	9.15	92	82.4
	Diabetescare.net	93	94	85	89	85	83	82	8.7	89	79.68
	CDC Centers for Diseases Control	88	92	87	88	82	81	89	9.4	90	78.24
	Saudi Diabetes Association	92	84	86	90	85	86	89	9.3	85	76.98
	diabetes-edu.com	90	82	79	78	85	84	79	13	91	72.42
	Kuwaiti Group for Diabetics	87	79	83	86	79	80	79	16.3	82	70.7

Table (11): evaluation result of first reviewer.

	Site name	Criteria									Evaluation
		Design Site	Update Site	Hyperlinks	Ability to convince visitor	Insufficient information	Use of visual effects	Data on the Resource	Time input	Consistency content	
Second reviewer	Global Diabetes Community	90	94	94	94	92	90	92	4.5	94	90.09
	Diabetes Health Centre	88	92	93	89	92	88	88	6	91	88.51
	American Diabetes Association	90	91	89	88	91	87	89	5.7	93	86.22
	Canadian Diabetes Association	89	92	88	88	94	90	89	9	91	85.99
	Real Diabetes Truth	88	86	93	88	89	86	89	8.9	92	85.70
	Australian diabetes association	89	88	90	89	85	86	88	10	89	82.65
	International Diabetes Federation	88	87	86	82	83	76	89	9.15	85	82.41
	Diabetescare.net	89	86	85	83	79	77	82	8.7	87	80.62
	CDC Centers for Diseases Control	86	90	82	78	82	78	84	9.4	87	78.71
	Saudi Diabetes Association	87	79	79	74	79	75	80	9.3	81	77.90
	diabetes-edu.com	88	78	77	77	78	78	79	13	79	72.76
	Kuwaiti Group for Diabetics	83	75	76	79	76	74	77	16.3	78	70.79

Table (12): Evaluation result of second reviewer.

	Site name	Criteria									Evaluation
		Design Site	Update Site	Hyperlinks	Ability to convince visitor	Insufficient information	Use of visual effects	Data on the Resource	Time input	Consistency content	
Third reviewer	Global Diabetes Community	89	95	90	90	95	97	93	3	91	89.00
	Diabetes Health Centre	84	94	87	93	89	88	90	4.5	86	87.32
	American Diabetes Association	86	90	85	84	92	84	87	5	89	86.27
	Canadian Diabetes Association	92	89	90	85	84	85	89	8.8	93	85.65
	Real Diabetes Truth	86	87	84	87	88	94	88	9	90	84.70
	Australian diabetes association	88	86	96	83	85	83	80	9.7	92	82.35
	International Diabetes Federation	84	84	84	79	87	79	89	8.5	83	82.46
	Diabetescare.net	79	84	86	80	83	80	78	10	86	79.83
	CDC Centers for Diseases Control	87	81	93	74	86	78	79	9.1	93	78.55
	Saudi Diabetes Association	85	80	85	75	82	57	77	9.3	82	76.90
	diabetes-edu.com	83	77	78	73	77	78	75	13.2	79	72.61
	Kuwaiti Group for Diabetics	80	78	77	74	78	82	77	17	79	70.12

Table (13): Evaluation result of third reviewer.

	Site name	Criteria									Evaluation
		Design Site	Update Site	Hyperlinks	Ability to convince visitor	Insufficient information	Use of visual effects	Data on the Resource	Time input	Consistency content	
Fourth reviewer	Global Diabetes Community	94	96	94	91	90	92	89	2	98	89.84
	Diabetes Health Centre	89	90	94	87	95	95	89	6	92	87.56
	American Diabetes Association	94	87	90	88	85	87	91	7	94	86.58
	Canadian Diabetes Association	92	91	89	95	88	85	89	8	87	85.44
	Real Diabetes Truth	85	88	82	85	85	83	85	9	85	84.86
	Australian diabetes association	86	84	87	86	79	84	87	8.7	79	82.24
	International Diabetes Federation	87	83	78	87	83	83	78	9.6	83	82.47
	Diabetescare.net	84	79	86	88	80	79	79	8.7	85	79.19
	CDC Centers for Diseases Control	79	78	74	79	76	78	74	9.3	76	78.88
	Saudi Diabetes Association	80	75	62	80	77	75	62	8.2	77	76.48
	diabetes-edu.com	84	79	73	74	82	78	75	14.5	79	72.00
	Kuwaiti Group for Diabetics	79	74	76	83	80	70	76	16	77	70.72

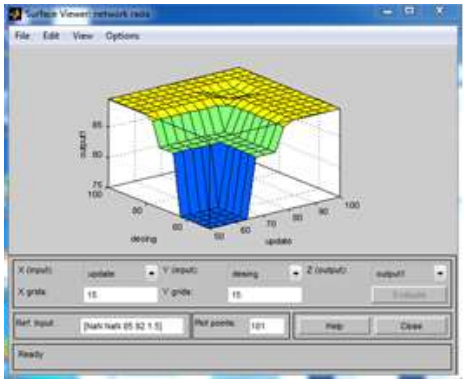
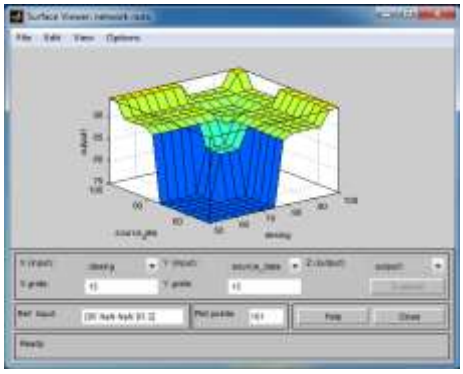
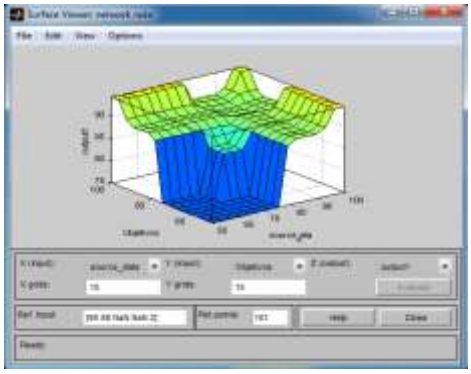
Table (14): Evaluation result of fourth reviewer.

(9)

	Site name	Criteria									Evaluation
		Design Site	Update Site	Hyperlinks	Ability to convince visitor	Insufficient information	Use of visual effects	Data on the Resource	Time input	Consistency content	
Fifth reviewer	Global Diabetes Community	97	94	93	94	89	94	89	1.5	95	89.62
	Diabetes Health Centre	98	93	88	93	90	93	89	4	97	87.55
	American Diabetes Association	88	93	89	95	88	95	86	4.5	87	86.54
	Canadian Diabetes Association	87	88	86	88	87	88	86	7.5	87	85.80
	Real Diabetes Truth	85	87	87	87	85	87	87	8.3	88	84.90
	Australian diabetes association	86	85	82	85	86	85	82	8.4	76	82.54
	International Diabetes Federation	84	83	80	83	84	83	80	8.1	80	82.49
	Diabetescare.net	87	88	87	79	85	79	85	8.6	93	79.85
	CDC Centers for Diseases Control	77	77	74	77	77	77	74	8.7	77	78.43
	Saudi Diabetes Association	84	85	78	85	86	83	78	9	79	76.99
	diabetes-edu.com	79	75	74	75	79	75	74	13.5	75	72.47
	Kuwaiti Group for Diabetics	73	74	75	74	73	74	77	15	71	70.76

Table (15): Evaluation result of fifth reviewer.

We have been depend on the MATLAB program to get the results of our proposed because it has a good library is available where (tools of fuzzy system), and by the compiler code that was written to build fuzzy model to evaluate the Diabetes Medical Sites. For the application of the proposed model in the evaluation of Diabetes Medical Sites has been selected 12 Diabetes Medical Sites after seeing more than 30 Diabetes Medical Sites, we noticed that the selected sites of the most relevant sites in how foretelling injury diabetes and instructions to be followed in case of the disease and methods of treatment, was evaluated selected sites by 30 reviewer. The proposed system has been feeding the input of the proposed numerical values on the membership functions used in the proposed system and stage turn it into fuzzy values and the completion of the second stage of the system inference stage then deffuzification stage, figure (5) and table (16) a and b shows the results obtained from the evaluation process.

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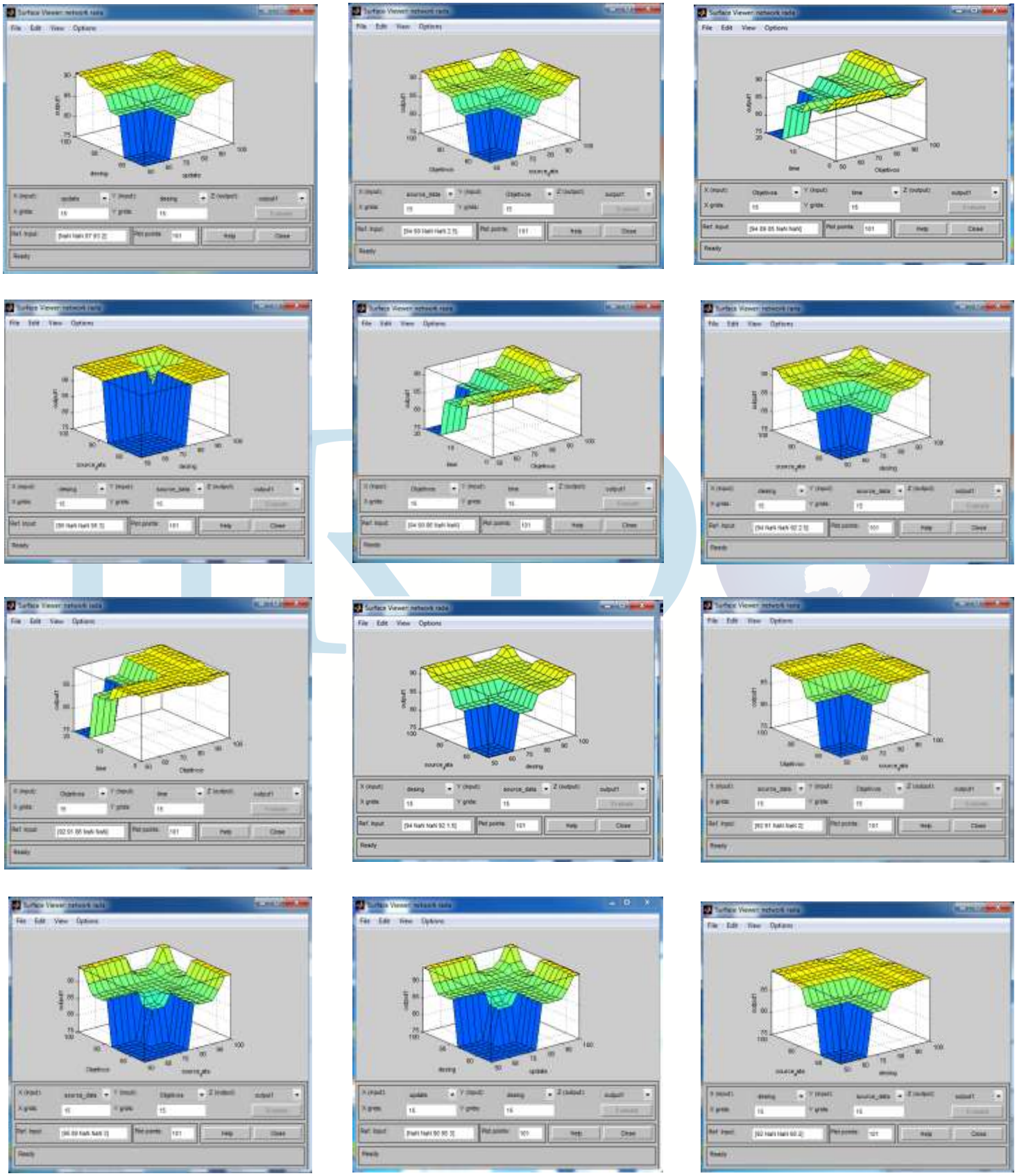

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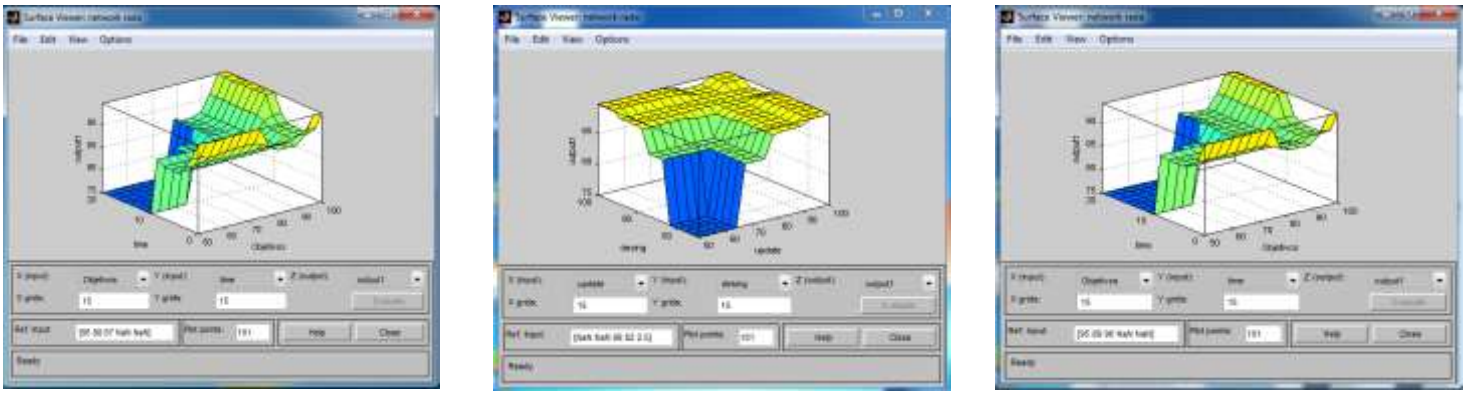

Figure (5): Evaluation result of proposed model.

No.	Diabetes Medical Sites Name	Link of Diabetes Medical Sites	Design Site	Use of visual and audio	Consistency content with goals of site	Insufficient information	Hyperlinks	Ability of User	Data on the sources	Time Input	Update Site
1	Global Diabetes Community	Diabetes.co.uk	V.G	G	E	V.G	G	G	V.G	E	E
2	Diabetes Health Centre	www.webmd.com/diabetes	V.G	V.G	V.G	E	V.G	V.G	G	V.G	E
3	American Diabetes Association	www.diabetes.org	V.G	G	V.G	V.G	G	G	V.G	V.G	V.G
4	Canadian Diabetes Association	www.diabetes.ca	V.G	G	V.G	V.G	G	G	V.G	G	V.G
5	Real Diabetes Truth	www.realdiabetestruth.com	V.G	G	V.G	G	G	G	V.G	G	V.G
6	Australian diabetes association	www.diabetesaustralia.com.au	V.G	G	G	G	V.G	G	V.G	G	V.G
7	International Diabetes Federation	www.idf.org	V.G	G	V.G	G	G	G	G	G	V.G
8	Diabetescare.net	www.diabetescare.net	G	G	G	G	V.G	V.G	G	G	G
9	CDC Centers for Diseases Control	www.cdc.gov/diabetes	G	G	G	V.G	G	G	G	G	G
10	Saudi Diabetes Association	www.alsukkary.org.sa	G	G	G	G	M	G	P	G	G
11	diabetes-edu.com	www.diabetes-edu.com	G	G	M	M	M	P	G	M	G
12	Kuwaiti Group for Diabetics	www.sokary.org	G	M	M	G	P	M	P	P	G

(a)

No.	Site Name	Evaluation	
		Numerical Evaluation	Qualitative Evaluation
1	Global Diabetes Community	89.518	High Very Good
2	Diabetes Health Centre	87.696	High Very Good
3	American Diabetes Association	86.378	High Very Good
4	Canadian Diabetes Association	85.732	High Very Good
5	Real Diabetes Truth	84.976	Low Very Good
6	Australian diabetes association	82.42	Low Very Good
7	International Diabetes Federation	82.098	Low Very Good
8	Diabetescare.net	79.834	High Good
9	CDC Centers for Diseases Control	78.562	High Good
10	Saudi Diabetes Association	77.05	High Good
11	Diabetes-edu.com	72.452	Low Good
12	Kuwaiti Group for Diabetics	70.618	Low Good

(b)

Table (16): Evaluation result of proposed model.

(12)

The Global Diabetes Community site got the highest degree of numerical evaluation of all reviewers and estimate (89.518) which is located within a high very good function and within the membership functions of its organic knowledge. While the Kuwaiti Group for Diabetics site at the end of the list under low field function and estimate (70.618). The rest of the sites have stabilized its evaluation degree between these two sites

Conclusion

This paper researches on Diabetes Medical Sites (DMSs) quality website evaluation. It is briefly introduced the theory and discussed the application of Fuzzy system. The evaluation of the DMSs quality depending on Design Site, Update Site, Hyperlinks, Ability of User, Insufficient, Information, Use of visual effects, Data on the sources, and time Input using a strong tool Fuzzy system in this work. Our proposed model was found to be very reliable and gave an overall success evaluation for selected 12 Diabetes Medical Sites.

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