European Journal of Computer Science and Information Technology
Vol.5, No.1, pp.33-44, February 2017
Published by European Centre for Research Training and Development UK (www.eajournals.org)

A PROJECT FOR AN INTELLIGENT MANAGEMENT SYSTEM: INTELLIGENT REDESIGN FOR MIS

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ABSTRACT: in this paper we present the architecture and several technical issues of an intelligent management system, which can realize MIS's intelligent redesign. This particular system, throughout its interactions with executives, automatically generated modules that lead to the accomplishments of executives' changing tasks. The generated modules have new friendly interface. They adapted to executives' role, computer skill, and special task. The adaptive behaviours of the system are verified by an experiment. It shows the system is superior to the prevailing systems.

KEYWORDS: Intelligent redesign; Intelligent Management System; artificial intelligent; fuzzy logic; fuzzy neural network

INTRODUCTION

Many barriers seem to obstruct implementation of MIS in companies, e.g. limited time for processing information, difficulties for using MIS proficiently, unsuitable of MIS for current business process etc.; particular attention was given to MIS's functions brought to executives[1]. Intelligent Management system integrates all the departments of an RTO (Research & Technology Organization) from Front Desk to Back Office, from Agents to Students, from Accounts to Financial Planning, from Events to Customer Relationship Management. It is also mentioned as an important support to managerial development of a company.

The problem of intelligent system, especially Intelligent Management System has been studied extensively, and two paradigms have emerged. In researches emphasized on information process, one tries to scan, filter, interpret information from external environment, especially from WebPages etc..[2], whereas in researches underlines system' ability to learn, one argues that learning from exploring the environment should be the main goal in developing AI[3].

Over the last decade, there has been significant development in IMS. Artificial intelligence techniques play important role in this process. The artificial intelligence techniques were advances in 1980 have led to systems that display surprising capabilities and in some cases perform better than experts in the field. Mark S. Fox has ever proposed an overview of the Intelligent Management System [4]. He believed that IMS was an ownership based application, which does not have hassles of paying after regular intervals. It

can help users customize the modules as per their requirements and mix and match for the perfect combination. To date, IMS's Examples can be found in many application fields [5-9].
The broad functional goals of the Intelligent Management System include: 1) Providing expert assistance in the accomplishment of professional and managerial tasks, and 2) Integrating and coordinating the management of the organization. Integrating AI (e.g. the experts' knowledge or system) with the experiences of the executives might have more importance than the function for acquiring external information in an intelligent system. Therefore, unlike the prevailing researches on automatic information gathering, filtering and searching, our research emphasizes on executives participatory and the application of AI.

Our research is concerned with reducing the cost of creating, maintaining, and adding new functionality by means of integration of AI and executives participatory. It is not sufficient to increase the effectiveness of one part of an organization, e.g., managerial, by increasing costs in another, namely programming and system support. Yet much of the software constructed today, while providing increased functionality, also requires increased programming support. Research and development must be concerned not only with functionality but with adaptability.

In this paper, we present a framework and some technical issues of intelligent System with intelligent redesign function. It is organized as follows. Section 2 reviews features of IMS and approaches employed in the prevailing intelligent system. In Section 3, a framework and technical details of intelligent system based on the integration of executives participatory and AI are presented. In Section 4, some experiment work have been done for verifying the system proposed in this paper, Section 5 discusses the direction of our future work.

INTELLIGENT MANAGEMENT SYSTEM

The major difference between intelligent management system and traditional MIS lies in three aspects. First, the former has unfixed system framework, whereas the latter is fixed one. It has good adaptability. When the user's needs change, classical software has to be rewritten. IMS can alter its processing and responses to fit the changes. Second, intelligent system has the accountability characteristic. Software users are usually unable to question how and why output was generated. It is a major obstacle affected the computer software acceptance. A module in IMS should be designed to explain its actions at various levels of detail, which will allow. Third, IMS is easy to access. The interfaces of MIS are idiosyncratic. It is difficult for users to learn and use the interfaces of a computer system. It is also a hard work for users to be re-educated, when the systems change to meet users' incremental requirements. Users want to communicate with a computer system meaningfully. IMS enables all personnel to realize their willingness. Graceful interface, which can interact with the user and provide guidance and help in deciding what the user needs, should be designed in IMS.

The approaches applied in intelligent management system is different from that used in the traditional MIS, too.Various methods were employed in information processing, including an adaptive weight method[10], Information Retrieval technology[11], time-driven filtering approaches[12], semantics-based recommender technology[13], dynamic instance adaptation, partial completion and case handling , stochastic and fuzzy Petri Nets , rough set theory [14], and integration of rough set theory and artificial neural network(data mining executives) [15]. However, seldom methods were really employed in enhancing the ability of MIS's learning. Although IMS and other advanced technologies such as expert system, AI, intelligent agent, machine learning, ANN etc. are closely linked. Thus, IMS has almost been ignored in recent years.

ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)

As an alternative, unstructured collaborative office management system, the operator computer management systems, visual programming platform, and visualization management system development platform have emerged[16-20]. They have to be developed by staff members in a company, if the company is not willing to pay extra costs. They are not intelligent system but programming soft packages needed no programming skills.

A FRAMEWORK OF INTELLIGENT REDESIGN

Intelligent redesign is a scheme which allows the system can be redesigned without the aid of the computer specialists or developed by staff members in company. The framework is illustrated in Fig.1,

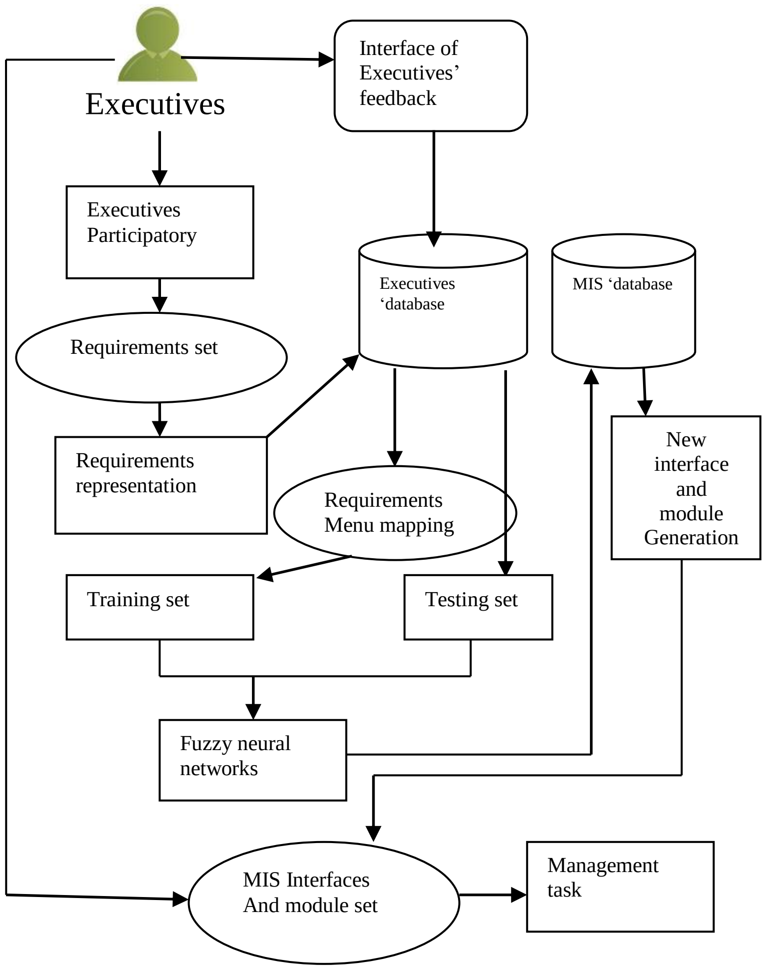

Fig. 1. key Structure of IMS

Executives' feedback

Executives' feedback can be classified into two categories, explicit one and implicit one. Explicit feedback can be collected by the interactive interface which can gather the information about the executives' situation such as, the role in a company, the computer operation skill, how busy he is, etc.. Implicit feedback can be reflected by the log file embedded in the MIS, which can gather the information executives interested. Implicit feedback techniques are often used for query expansion and user profiling in information retrieval tasks. Implicit feedback techniques take advantage of user behaviour to understand

ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)

user interests and preferences. Oard and Kim[21] classified observable feedback behaviours according to two axes, Behaviour Category and Minimum Scope. The observable feedback behaviours in our system are illustrated by the frequency for each unit in the executive database. Table 1 - 3 shows the detail.

TABLE 1 EXECUTIVES' PREFERENCES TO BUTTON OR MENU

Button or menu name / Action	a	b	c	d
Click frequency				

TABLE 2 EXECUTIVES' PREFERENCES TO TABLE

Table name / Action	a	b	c	d
Browse frequency				
Query frequency				
Print frequency				

TABLE 3 EXECUTIVES' PREFERENCES TO COLUMN

Column / Action	a	b	c	d
Select frequency				
Edit frequency				

Executive' participatory

Three kinds of relationships with the upstream and downstream enterprises are as follows: the Sale and Purchase relationship, service relationship, contractual relationship. According to the software system level, the extent of the executives involved in software can be divided into four levels, i.e. the data layer, the application layer, middleware participation, and system construct participate.

The executives refer to legal persons or individuals engaged in the trading of goods or services for profit. He can be the production enterprise worker, a team leader, foreman, workshop director, president. He can be salesperson, leader, manager, general manager of retailers[22].Besides the implicit feedback of the executives, the executives' requirements also can be represented by fuzzy membership functions. Executives participate in this process in terms of calibration and fuzzy if-then rules.Another function of executives participatory is to monitor the result of the redesign of MIS. If the result is not satisfactory, the process will be re-operated until satisfactory result can be obtained.

ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)

Since both executives and their requirements will be changed over time, when the change has been made, MIS will be redesigned according to the changed requirements.

Application of AI

In Unified Theories of Cognition, Allen Newell defines intelligence as: the degree to which a system approximates a knowledge-level system.Artificial Intelligence, in light of definition of intelligence, is simply the application of artificial or non-naturally occurring systems that use the knowledge-level to achieve goals. A more practical definition that has been used for AI is attempting to build artificial systems that will perform better on tasks that humans currently do better. Thus, at present, tasks like real number division are not AI because computers easily do that task better (faster with less error) than humans.

The redesign of MIS is a task which human currently do better, whereas current MIS itself can do not do better. How can our framework finish this task perfectly? That could mainly contribute to the application of AI. Here we only resort to the fuzzy logic and artificial neural network. These two methodologies are combined to construct a fuzzy neural network inference system to solve the core problems of MIS's redesign.

EXPERIMENTS

Invoicing system has been widely used in the field of management, as one of these applications, Invoicing system hold a prominent position in business process[23][24]. With the help of invoicing system, executives can implement the complex operation that cannot be realized only by manual. Besides, by this way, the affection caused by salesman can be decreased in some degree, and the accuracy, stability and reliability are improved.

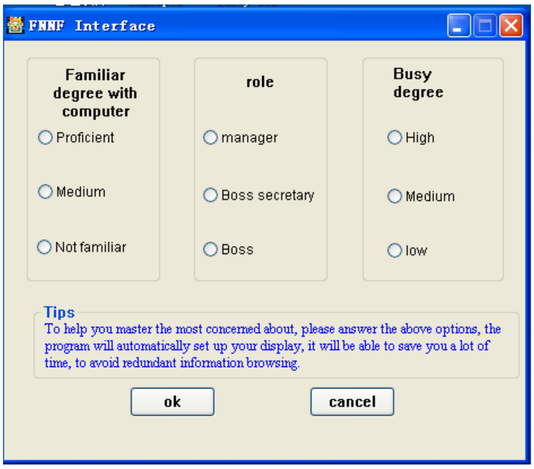

Fig. 2(a) inputs of user interface

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Fig. 2(b) modules in IMS

The invoicing system designed in this paper is a simplified system, consisting of filter module, ordering module, users information-collecting module, inventory module, key data module, data maintenance module as shown in Fig. 2(a) and Fig. 2(b).The filter module is responsible for displaying the buttons associated with users state, and exposing the business information to the some extent. We know that no two companies work in the similar way and no solution for all the organization. IMS integrates the Legacy Systems and adds a pinch of intelligent parts in process specific improvements. IMS customize as per customers' requirements. The integration of human domain knowledge represented via patterns can significantly improve design recovery results. The recognition of a program's design leads to recurring patterns that, at present, have to be identified in demanding tasks by a human engineer without automated assistance[24].

One of the major stumbling blocks in the systematic analysis of IMS is the unavailability of process instrumentation for data collection. Yet the availability of the data solves only half of the problem. The other is the automatic analysis of data to find relations between inputs of user interface and the next interface or buttons displayed. To present the problem clearly and reduce the complexity of IMS, an invoicing system is considered in this paper.

The structures of user state and Extent of expected information or action is described in Fig. 1.The increasing attention has been paid to the practical application of fuzzy theory to solve real-world problem. When managerial task is described, fuzzy set is employed. It translates the requirements of users into linguistic information, and applies the users' experience to IMS with if–then rules.

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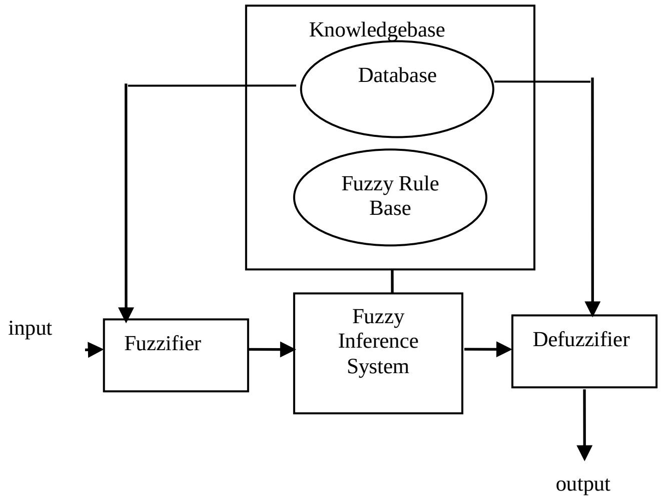

Fig. 3 Structure of fuzzy rule-based system.

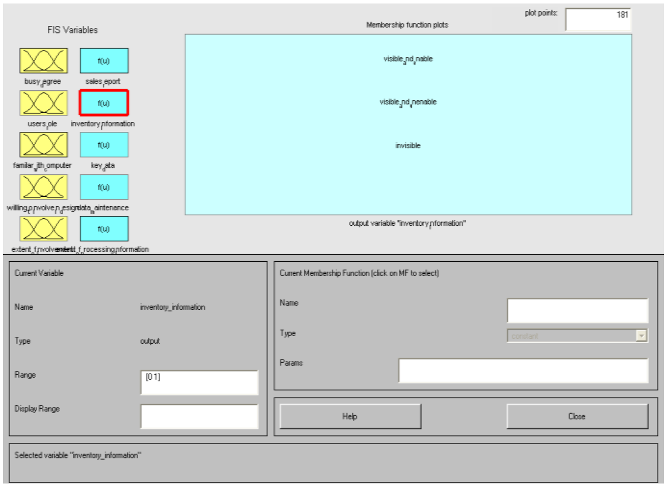

Fig. 4 Fuzzy model in MATLAB platform

Requirements and menu mapping

Identifying the system variables (i.e. input and output variables) is the first step in system modelling. It has already been described in fig.2 of Section 2 that, busy degree, Users role, Familiar with computer, willing to design and Involvement extent influence extent of expected information or action significantly; Those inputs affect the output to a large extent. Hence, these parameters are chosen as input variables and sales reports, inventory information, key data, data maintenance, the degree of information as output variables. Membership functions can represent fuzziness in a fuzzy set. It classifies the element in the set whatever it is discrete or continuous. The membership function are introduced in the inputs(i.e. busy degree, users role, familiar with computer, willing to design and involvement extent) in order to describe various levels of fuzzy sets in the input functions.

In this paper, Gaussian membership functions are used to normalize the crisp inputs because of their widely employed. The Gaussian membership functions as described in Eq. (1).are used to convert the linguistic values in the computational efficiency. The Gaussian membership function is range of 0–1, where c, σ are the parameters of the linguistic value and x is the range of the input parameters. In this proposed model, each input has three gauss membership functions. In these lection procedures, the abovementioned inputs and the outputs were taken in the form of linguistic format which displayed an important role in the application of fuzzy logic. For example, Busy degree={low, medium, high}, Users role ={boss, sales manager, salesperson}, Familiar with computer ={low, medium, high}. The placement of curves is approximate over the universe of discourse; the number of curves and the overlapping of curves were important criteria's considered while defining membership functions. The assignment of membership function is done by intuition as knowledge regarding linguistic variables is provided from Table 4. The graphical representations of membership functions of different input variables are shown in Figs. 4–6.

$$f(x,\sigma,c) = e^{\frac{(x-c)^2}{2\sigma^2}} \qquad (1)$$

The output changes to a set of constant mathematical function(Fig.4).The output functions are represented as low, medium, high with constant output level as shown in table1 and Fig. 4.

TABLE 4 REPRESENTATION OF MEMBERSHIP FUNCTION AND PARAMETERS

variables	name	range	MF	parameters
inputs	Busy degree	[0 1]	low	[0.2123 0]
			medium	[0.2123 0.5]
			high	[0.2123 1]
	Users role	[0 1]	boss	[0]
			Sales manager	[0.5]
			salesperson	[1]
	Familiar with computer	[0 1]	low	[0.2123 0]
			medium	[0.2123 0.5]
			high	[0.2123 1]
	Willing to design	[0 1]	low	[0.2123 0]
			medium	[0.2123 0.5]
			high	[0.2123 1]
	Involvement extent	[0 1]	low	[0.2123 0]
			medium	[0.2123 0.5]
			high	[0.2123 1]
outputs	sales reports	[0 1]	hide	[0]
			display	[1]
	inventory information	[0 1]	hide	[0]
			display	[1]
	key data	[0 1]	hide	[0]
			display	[1]
	data maintenance	[0 1]	hide	[0]
			display	[1]
	The degree of information	[0 1]	low	[0.5]
			high	[1]

1) Determination of linguistic rule-base

The relationship between input and the output were represented in the form of IF-THEN rules. As per the fuzzy systems, the inputs, i.e. busy degree, Users role, Familiar with computer, willing to design and Involvement extent have three membership functions each. Taking non repetitive 5 pieces of rules have been generated. That we do not take too many rules is for the sake of simplicity. It has the satisfactory results based on our previous research[25]. Fuzzy system is generated as follows:

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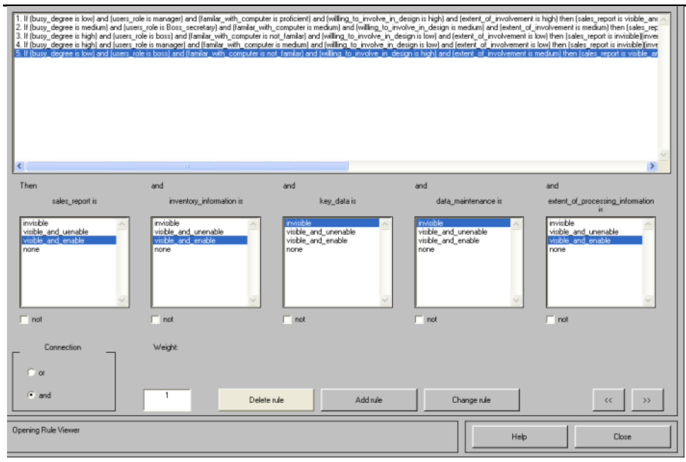


Fig. 5. The fuzzy rule-base

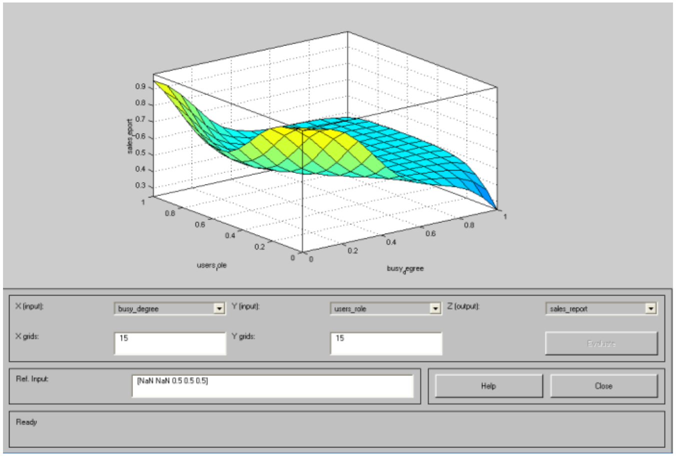


Fig. 6. Representation of linguistic rule-base in MATLAB platform

2) Defuzzification

Takagi - Sugeno model of fuzzy logic is a more special class of fuzzy logic system. According to the control rules in Takagi - Sugeno system, we can find that if there is no defuzzifier, the output is still exact value.The advantages of Takagi - Sugeno fuzzy logic system is to represent the output with a linear combination of input values.Hence, parameter estimation method can be employed to determine the parameters of the system. The general algorithm is omitted due to the limited space.

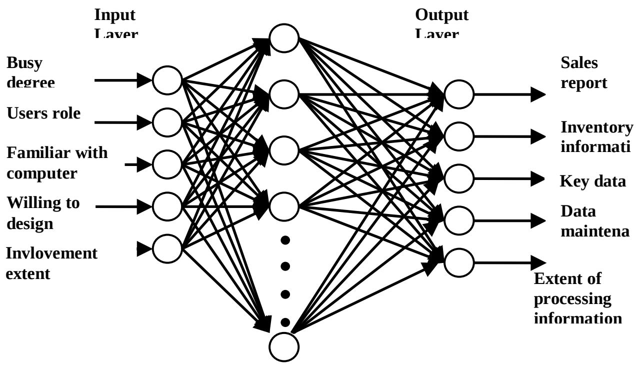
Fuzzy Neural Network

Software intelligence is a complex process and there exists a non-linear relationship between software valid interface or information and the users' current state. We found that users' intrinsic motivation is decisive through our depth interviews. Since people work in different time, space and related factors, sometimes the user need simple software to display the results, and sometimes want to know more. Therefore, a robust methodology is needed to study this relationship. In this section, corresponds to the response proposed a statistical method used to determine the relationship of the relevant parameters. This method is based on fuzzy neural network (FNN), it contains database training to map executives' feedback and functional module. The details of this technique have been described in our relevant research paper[26]. Busy degree, Users role, Familiar with computer, willing to participate in software design and Involvement extent is regarded as the system input parameters. Each of these parameters is characterized by one neuron and consequently the input layer in the FNN structure has five neurons. The database is built considering experiments at the limit ranges of each parameter. Experimental result sets are used to

ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)

train the FNN in order to understand the input–output correlations. The database is then divided into two categories, namely: (i) a training category, which is exclusively used to adjust the network weights and (ii) a test category, which corresponds to the set that validates the results of the training protocol. The input variables are normalized so as to lie in the same range group of 0–1. Different

FNN structures (I–H–O) with varying number of neurons in the hidden layer are tested at constant cycles, learning rate, error tolerance, momentum parameter, and noise factor and slope parameter. Figure 7 is based on the minimum error criterion is chosen as a block diagram of the input and output data training. The learning rate is 0.7. The number of hidden layer neurons 18. The number of cycles selected during training is high enough so that the FNN models could be rigorously trained. 75% of the data used for training, 25% of the data used for testing. Table 5 shows for the network training parameters.



Hidden Layer(18 nodes)

Fig. 7. The three layer neural network

TABLE 5 INPUT PARAMETERS SELECTED FOR TRAINING.

Input parameters for training	Values
Error tolerance	0.0001
Learning rate (S)	0.7
Momentum parameter	0.05
Noise factor (NF)	0.01
Number of epochs	30,000
Number of hidden layer	18
Number of input layer neuron (I)	5
Number of output layer neuron (O)	5

DISCUSSIONS AND FUTURE WORK

In this study, a framework of intelligent system for redesigning intelligent management is proposed, which executives can participate in obtaining the functional module they want. The contributions of this study are, (1) this research is based on in-depth interviews. It will conduct to the demand analysis of IMS software development. (2) Since it is based on an experiment, the results can be applied to actual intelligent management system development. (3) It has a certain forward-looking. Although the inventory management system is a simple one, its intelligent idea has a major supporting role for the development of enterprises, especially for that of SMEs (small and medium enterprises). Therefore, from this perspective, it has far-reaching significance of innovation for business intelligence management system.

The limitations of this study are, (1) too much attention to the details of the study, may lose the grasp of the overall framework of the intelligent management system. (2) The intelligent management system

ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)

development work, is still a research prototype, its commercial application is not yet in full swing, which affects the actual promotion of this study. (3) There are some technical details need to dig deeper to come up with better technical solutions. In the future, the technology applications should be further expanded. Double fuzzy controller and adaptive fuzzy control may be other research directions.

ACKNOWLEDGMENT

This research is supported by Liaoning Social Science funds (Project No. L07DJY067) and Ph.D. support funds (20066201). It is also supported by the "Dalian Science and Technology Bureau S&T funds (2011J21DW020)".

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ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)