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A Review Note on Intelligent Interface Approaches Based on Fuzzy Logic

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Abstract: As the intelligent interfaces are important at the international level and very rich in concepts, methods, models and tools. This article Reviews a number of types concerning intelligent interfaces with particular concern for the ability such interfaces to be flexible, adaptive, tolerant of human error & supportive both of human operator & intelligent agents. As a result types of intelligent interfaces & examples of approaches using fuzzy logic are discussed in detail.

Keywords: *Fuzzy Logic: Intelligent Interfaces*

I. INTRODUCTION

Today's increasingly complex industrial systems requires highly skilled operators who need to control several parameters at once in control room .a major role of human – machine interface is to bridge the gap that exist between human & machines. These human operators have often performs complex cognitive task in various situations, that the automatic machines are not able to realize. This implies human reliability should be ensured, even with reliable, certain circumstances may bring about some errors. One way of avoiding such errors is to develop intelligent interfaces.

This article reviews the no of types of intelligent interfaces based on fuzzy logic. Fuzzy logic can be considered as a mathematical theory combining multi valued logic , probability theory and artificial intelligent to simulate the human approach in the solution of various problems by using approximate reasoning to relate different data sets and make decisions. Fuzzy logic which is the practical artificial intelligence method operator activity modeling. The main appeal of fuzzy logic models is that they take into account the imprecision and uncertainty of human judgment.

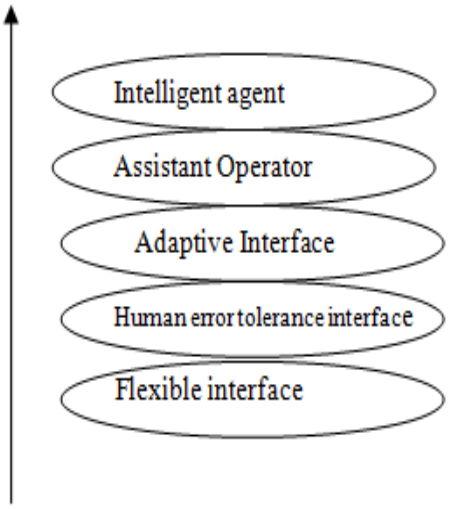
II. INTELLIGENT INTERFACE APPROACHES

A Research on intelligent interfaces started at the beginning of the 1980's .A common definition of an intelligent interface is one which provides tools to minimize the cognitive distance between the mental model which the user has of the task and the way in which the task is presented to the user by the computer when the task is performed (Hancock and Chignell (1989)) A human machine interface is an intelligent entity which mediates between two or more interactive agents each of which has either imperfect understanding of the way in which the others act or an imperfect understanding of the way in which the others communicate.

A. Types of intelligent interfaces

Most interfaces have an important characteristic in common namely adoptability. Fig1 classifies five main types of their degree of intelligence.

Degree of "intelligence"(in the sense of Artificial Intelligence)



- **Flexible Interfaces**

Flexible interfaces are also called as adaptable interface allows adaptation to the performance of the user & accordingly to the system in which it is used. A flexible interface uses only a low level of intelligence and generally consists of a database used by a presentation controller which later is guided by the user according to the approach to a particular problem.

According to Ribeiro and Moreira(2003) describe a flexible query interface built for a relational database of the 500 biggest non-financial Portuguese companies. the interface is based on fuzzy logic in which queries in natural languages with pre-defined syntactical structures and performed (for instance "has company X a high financial health?"), and the system uses a fuzzy natural language process to provide answers (for instance,"Finantial health is average (43%/), because cash flow is above average (61%) solvency is very small (14%) financial autonomy is high […]")

- **Human Error Tolerant Interfaces.**

These interfaces are based on studies of the kind of errors human make in simulated conditions. In these studies, errors are identified by recording actions that result in the behavior of the human – machine system failing to meet well defined criteria of productivity or safety. The notion is to use such studies to develop ways that, in the real world, will replace, improve, or cancel inappropriate human actions (Beka Be Nguema 1992)

Pornpanomchai et al. (2001) are interested in situations in which the users do not use a keyboard to interact with a computer. They propose a non-keyboard computer interaction by using a write-pen or mouse to write Thai handwritten characters and words. In their approach, the fuzzy logic set is used to identify uncertain handwritten character shapes (in such approach, we can consider as an error a badly written character or word) There tests show precision results equal to 97.82%.

- **Adaptive interface**

An adaptive human machine interface is itself should take into account the two previous approaches but generalize them and adopt itself to the cognitive behavior and the tasks of the user.(Edmonds,1981;Kolski et al.,1992)

According to Mantyjarvi and Seppanen(2003) who are focused on the adaptation of applications representing information in handled devices :in these applications, the user is continuously moving in several simultaneous fuzzy contexts like environment loudness and illuminations. These authors explain that context-aware applications must be able to operate sensibly even if the context recognition is not 100%relible and there are multiple contexts present at the same time. So they propose an approach for adapting applications according to fuzzy context representation .User reactions indicate that (i)they accept adaptation while insisting on retaining the most control over their device.(ii)abrupt adaptation and instability should be avoided in the application control.

- **Operator assistant**

An operator assistant behaves almost like another human assistant or co-pilot (Boy 1991)and helps the user to complete tasks .Boy is one of the leader in this area as a result of his work for NASA on intelligent operator assistant projects gave the following example .

According to Boy and Tessier (1985) during the MESSAGE project of analysis and evaluation of air-craft cock-pits ,an operator assistant (copilot as assistant) has been designed and evaluated. It is able to generate and execute tasks either in parallel, or in sequence with the aim to reason like a copilot, such an assistant is characterised by a cognitive architecture, in its long term memory, so called situational and analytical representations are implemented and accessible. Fuzzy logic has been used to model different types of situations. For instance, at a given time the perceived situation is a particular image of the local environment and is characterized by incomplete , uncertain and imprecise components; the desired situation is composed with a set of fuzzy goals which the operator intends to reach.

- **Interface using intelligent agents**

The concept of an intelligent agent arises from the possibility of decomposing the human machine system. An intelligent agent has ability to model co-operative human machine system. These agents would work in parallel or would co-operate with the goal of solving their relevance problems in the task to be performed.

According to Agah and Tanie (2000) propose intelligent graphical user interface design utilizing so called fuzzy agents. The objective of these agents is to understand the intents of the user, and to transform the deduced intentions into system actions. For instance the motions of the mouse cursor can be interpreted by the agents and the mouse cursor can be moved according to the conveyed intentions in these conditions, the amount of work required by the user can be reduced. Each agent is implemented using fuzzy logic control and uses a set of fuzzy rules making possible the identification of user intentions and the proposition of system actions.

CONCLUSION

Each of these tools has its own characteristic and must be used in the situations to which it is adopted .in other word the intelligent interfaces must decide which kind of medium is the most adopted in the current situation for the user concerned .when the human task are complex, it is a difficult work for the designer and a source of many imprecision or uncertainties .In these conditions, fuzzy logic can be potentially very useful.

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