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Mobile System's Creditability Management in P2P Networks using Mamdani Fuzzy Inference Systems

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***Abstract*-- New mobile devices and mobile Internet applications are transforming the traditional concept of computing and user's experience. Peer to peer (P2P) mobile systems are autonomous and decentralized systems. Each peer in the network is heterogeneous and is not fully reliable. In this paper it has been tried to estimate the creditability of each peer in the network using Mamdani Fuzzy Inference Systems. Application programs or user take decision on various things with the help of proposed fuzzy system. This paper is extension and implementation of fuzzy reference engine of a frame work [1] works at transport layer context system in the transport layer for an individual's changing context. The proposed system is also useful in solving the large scale data dissemination problem by using creditability of mobile system user.**

***Keywords*-- Mobile System, Fuzzy Inference System, P2P, Mamdani FIS, Creditability, QoS**

I INTRODUCTION

Peer to Peer (P2P) mobile systems are one of the popular networks systems which are used in many areas of communication for many years. This is because P2P mobile systems are autonomous systems where any number of systems can come and join the network without the need for any central coordination. P2P mobile systems rely on the collaboration of two or more peers using appropriate information and communication systems, without the necessity for central co-ordination. Since peers are autonomous, they determine for themselves when to cooperate, when to cease cooperating, and how to conduct themselves. For example, a peer may choose to delay the provision of information, and reduce its quality. To function effectively peers must manage the risk of interactions failing or having reduced performance. So trust holds the key for security in P2P mobile systems.

In peer to peer system [1], mobile systems interact with other nearby systems. A system creates a list of mobile systems which interact with it and stores their identity known or unknown. Based on this identity fuzzy decision will be taken. Creditability will be considered as low, medium and high. On this basis mobile systems will be analysed by p2p system and by user's input. According to the results of recent surveys by several internet service providers [3] more than 50% of internet traffic is due to P2P applications, sometimes even more than 80%. Moreover, previous research shows that trust-based reputation or recommendation systems have an economic impact, for example, affecting the prices or the sale of products for the e-commerce situation. The mobile phones (smart phones) and PDAs are providing multifarious applications and services. These applications adapt as per the user's situation still a major issue must be addressed to efficaciously select services for adaption according to the user's current context [5-7]. Due to regular introduction of new mobile devices, [8-10] new problems frequently arising thereby demanding new paradigms for computing.

In [11] authors have worked on adaptation technique at transport layer to minimize the impact of varying and adverse network condition along with security and priority to satisfy the SLA.

The main objective of this proposed work is to invent a method to estimate the mobile allocation performance by taking into consideration the QoS requirements like creditability and identity of mobile machine. This technique is used to measure the entire Quality of service in mobile networks by using fuzzy logic inference system. This technique is very much accepted which supports a method for management of nonlinearities and uncertainties which may be present in physical structure [12].

It uses a linguistic terms, natural description, of various problems that can be solved instead of using terminology of relationships between particular numerical values [13]. In [14], the author proved that fuzzy logic is for solving complex problems, less computation required than the Neural Networks. Fuzzy set is the generalization of crisp set.

The typical models in P2P include EigenRep, Poblano, Bayesian Network trust etc. But the subjective nature of these models results in uncertainty and fuzziness in characters. Fuzzy logic offers better ability to handle this uncertainty and imprecision effectively. Fuzzy inference system uses linguistic terms and hedges to effectively represent trust. So by using Fuzzy logic, terms like creditability and identity are quantified and can be more accurately used for analysis of trust in P2P networks.

As we go down, section II describes the methodology used that is fuzzy logic, section III and IV describes proposed work based on the creditability and p2p model based on Mamdani FIS respectively, section V describes experimental work result and discussion of results and finally section VI describes conclusion and references.

II METHODOLOGY

2.1 Fuzzy inference system: The brief overview of the fuzzy logic and fuzzy controllers are discussed further in this topic.

2.2 Fuzzy logic: Fuzzy logic introduced in the year 1965 by Lotfi A. Zadeh, is a mathematical tool for dealing with uncertainty (Ross, 2010). It provides an mechanism for representing linguistic constructs such as "high", "low", "medium", "tall", In fuzzy systems, the values are indicated by a number ranging from 0 to 1. The membership function for the set maps each element of the set to a membership value between 0 and 1. Generally, Triangular or bell shaped functions are used for representing membership functions.

2.3 Mamdani FIS: Mamdani's fuzzy inference method is the most commonly seen fuzzy methodology. The Mamdani method finds the centroid of a two dimensional function rather than integrating across the two-dimensional function.

In order to compute the value of output using Mamdani FIS, one must go through the following six steps --

1. Determining a set of fuzzy rules
2. Fuzzifying the inputs using the input membership functions
3. Combining the fuzzified inputs according to the fuzzy rules to establish rule strength
4. Finding the consequence of the rule by combining the rule strength and the output membership function
5. Combining the consequences to get an output distribution and
6. Defuzzifying the output distribution (this step is only if a crisp output (class) is needed).

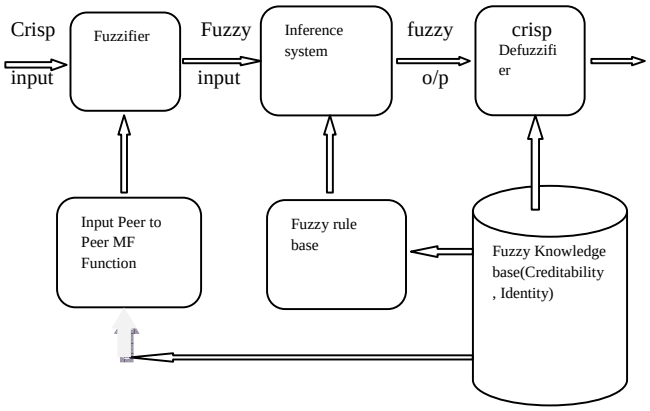

Fig. 1. Fuzzification process in proposed system

The basic model of a Mamdani FIS is as shown in Figure1. The process of Fuzzification is to map the inputs in to fuzzy sets via membership functions. Membership function is a curve which defines how each input value is mapped in to some value between 0 and 1 i.e., it defines the degree of membership. There are so many membership functions like Gaussian, Bell etc.Fuzzy rules are a collection of linguistic statements that describe how the FIS should make a decision regarding classifying an input or controlling an output. Fuzzy rules are of two types Generalized Modus Pones (GMP) and Generalized Modus Tollens(GMT).The input of the defuzzification process is a fuzzy set (the aggregate output set) and the output is a single number. There are various defuzzification techniques like SOM.

III PROPOSED GENERAL P2P CREDITABILITY MODEL

A General System model was designed for evaluating the creditability value of each peer in a P2P network. This is as shown in figure 2. The proposed work is helpful in situations when person goes to a new location or city or region or to make decision to buy something new or to know the opinion of people regarding something, etc. in the sense that even if the person doesn't interact with anyone he may still be able to visit the right location or purchase the right thing or may know the exact opinion just with the use of the proposed work. Also envision a scenario where an entity is interested in distributing its data / advertisement to a large number of mobile users, this proposed system work efficiently.

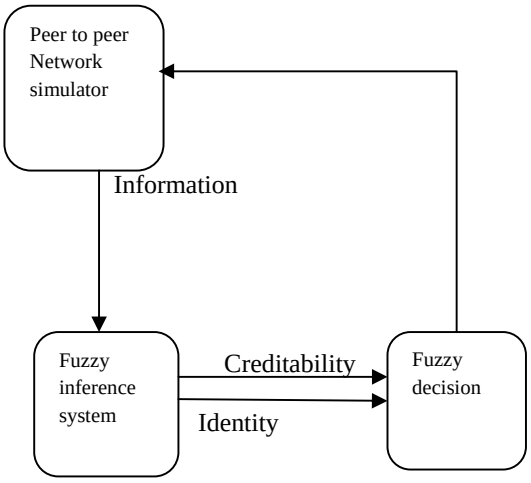

Fig. 2 General P2P Model

A peer to peer network simulator was employed to measure the attributes like creditability, machine identity (unknown/known) etc. according to the desired standards. These values were then fuzzified and given to a FIS which was hierarchical i.e. output of one FIS was given as input to another FIS. The output of FIS which was the credit value of member peer was assigned to each member peer and this value measured for a specified number of interactions if a file sharing application is considered. a mobile system is getting query/poll information from peer system then on the basis of creditability, unknown or known mobile systems Id and maximum mobile systems agreed on certain facts, fuzzy reference available in transport layer context system decide the result and final decision would be taken by user.

IV P2P Model Based On Mamdani Fuzzy Inference System

In this model the trust of a P2P network is calculated using two inputs – Creditability, and Identity. Creditability of Peer reflects the trust of the interactive peer and Identity of Peer reflects on the basis of unknown or known information of the mobile system.

4.1 Fuzzification- In the trust model the input and output values of Fuzzification are defined below

(1) Creditability degree: 1 (High), 0.5 (Medium), 0(Low)

(2)Machine Identity: 1 (Known), 0(Unknown)

4.2 FIS Rules-

Rule1: If Creditability=low, Identity=known,
Fuzzy decision= Yes

Rule2: If Creditability=low, Identity= unknown,
Fuzzy decision=No

Rule1: If Creditability=medium, Identity=known,
Fuzzy decision=Yes

Rule2: If Creditability=medium, Identity= unknown,
Fuzzy decision=No

Rule1: If Creditability=high, Identity=known,
Fuzzy decision=Yes

Rule2: If Creditability=high, Identity= unknown,
Fuzzy decision=Yes

4.3. Defuzzification

The input for the defuzzification is a fuzzy set (here the creditability and identity set) and the output is a fuzzy value. The most popular method, the 'SOM' which returns the area under the curve is used here.

V Evaluation Using Fuzzy Tool Box

Two inputs provided to the fuzzy logic toolbox are as shown in Fig 3

The formation of rules and fuzzy decision evaluation for a set of user defined input is shown in Fig 4.The inputs are as follows - Creditability= 0.261 and Identity= 0.959. The output waveforms are as obtained in Fig 4

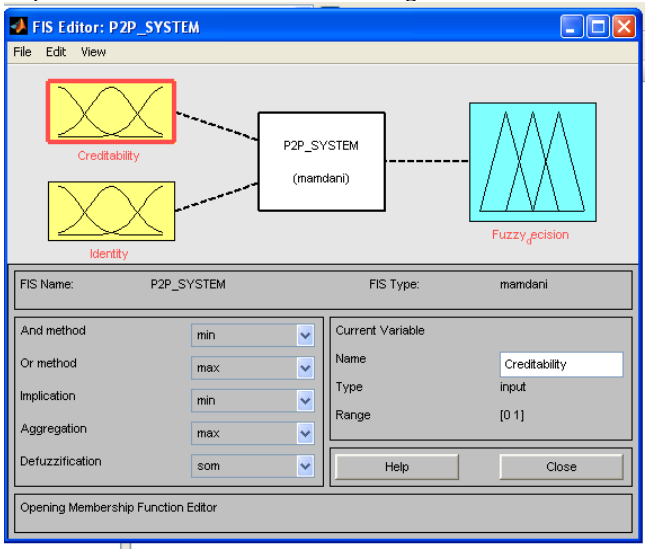

Fig.3. FIS Editor

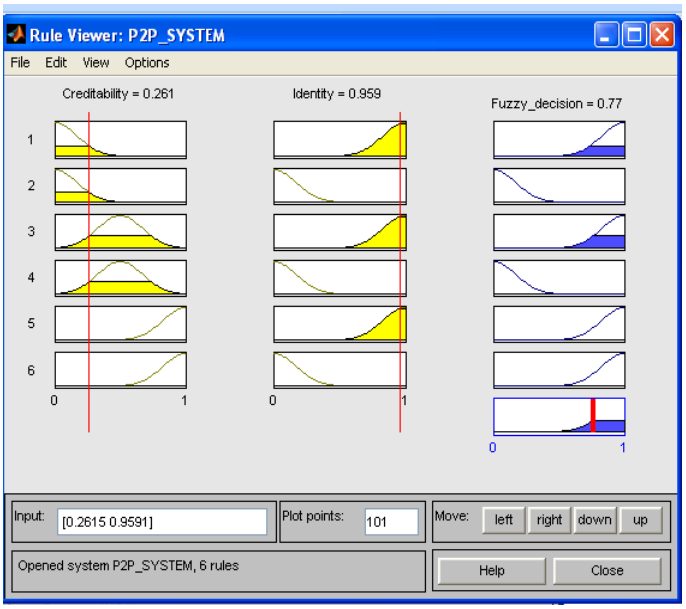

Fig. 4. Rule Viewer

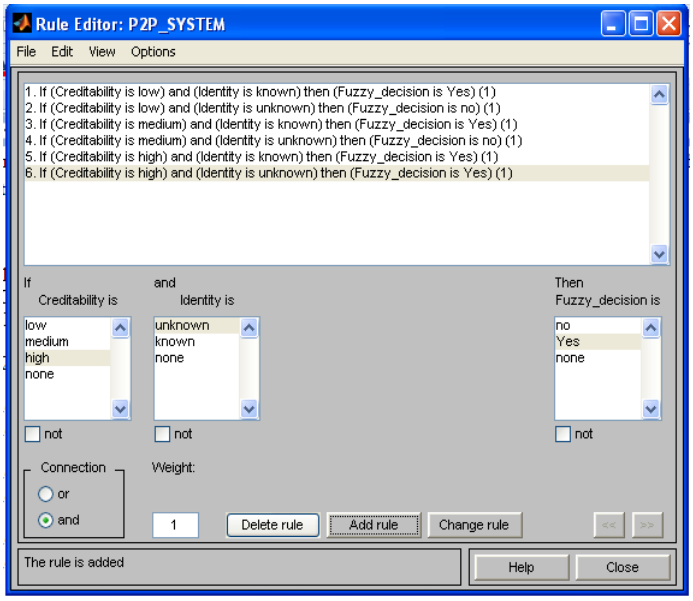

Fig.5. Fuzzy rule viewer

The output is also as shown in table 1.

Mobile Machine ID	*creditability*	*identity*	*fuzzy decision*
Number 1	0.37	0.95	0.88(YES)
Number 2	0.48	0.76	0.77(YES)
Number 3	0.54	0.50	0.51(YES)
Number 4	0.44	0.56	0.57(YES)
Number 5	0.75	0.72	0.73(YES)
Number 6	0.86	0.46	0.00(NO)
Number 7	0.22	0.80	0.78(YES)
Number 8	0.35	0.64	0.65(YES)
Number 9	0.35	0.39	0.00(NO)
Number 10	0.72	0.39	0.00(NO)

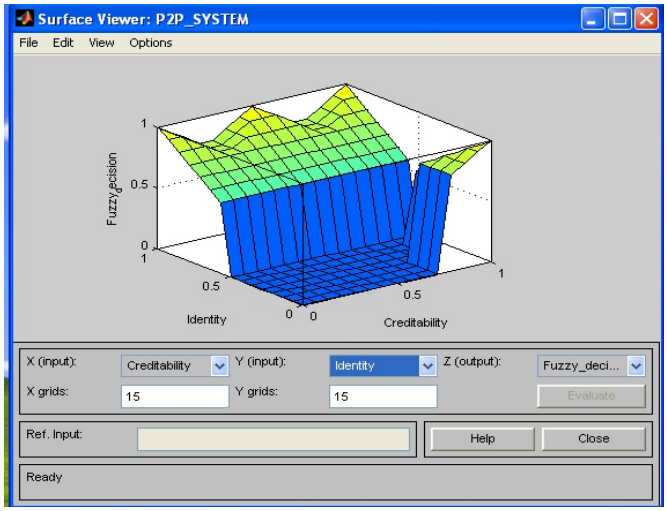

Fig. 6 Surface Viewer

VI CONCLUSION

In this paper a Mamdani fuzzy inference system for evaluating the working of P2P mobile systems is proposed. This is better than the previous methods because additional factors for analysing the trust have been considered which improves the accuracy. Additionally, as fuzzy logic is used, it handles the uncertainties involved better, while considering the factors for evaluating credits. Since fuzzy inference techniques are used, this method is less complex.

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