

AUTOMATED NEGOTIATION IN A MARKET BASED SYSTEM USING FUZZY LOGIC

Vinay D. Pahelkar¹, Nitin V. Londhe², Akash L. Tonde³, Ajay J. Palan⁴

Department of Information Technology
JSPM's Imperial College of Engineering & Research
Pune, India

¹vinaypahelkar@gmail.com, ²nitinlondhe4894@gmail.com,
³tondeakash@gmail.com, ⁴ajpalan@gmail.com

Abstract: *Negotiation process to get automated a mechanism that allows agent to negotiate automatically to reach mutually beneficial agreement is not a easy task .There may be many inconsistencies in the knowledge of other agents there may be conflicting objective of various agents all these should be properly handled by the mechanism autonomously and coordinate a joint approach to main domain task so that benefit goes to agents. When agents are involved in any of the negotiation process some of the profit percentage is being provided to that agent .This paper, thus, propose a model of negotiation for interaction between the seller and buyer without any intermediate agent. Instead of agent there will be a model of negotiation that will make the negotiation process more cost efficient by eliminating extra percentage give to agents likewise its predecessors this paper will take agent negotiation to another height making it more efficient and effective .We used the Fuzzy logic(Decision making function) which allows dealing with ambiguity and common sense reasoning .To achieve this objective our model will do all the negotiation process using this Fuzzy logic (decision making function).*

Keywords: *Automated negotiation, Fuzzy logic.*

1. INTRODUCTION

E-business has grown rapidly over the web because of ongoing improvement's internet technology, reliability security higher seeds and cheaper cost has permitted it boost. E-business is moving with a remark tread and is globally flourishing. E-business has transform business in to a network structure thus providing greater value for their products, less cost and access to their customer.

One of the most significant parts of E-business that businesses have not paid attention and focus to is the negotiation part of E-business. Negotiation can be defined as an interactive process which aims to chive a mutually beneficial din for both buyer and seller. Negotiate is

till done using emails formal meeting and phone calls and so on. This forms of negotiation can be time consuming and costly. There is a need for automated negotiation process to negotiate a deal autonomously for a part for a more efficient.

Currently E-negotiation takes place through exchanging offers and counter offers between agents until a deal is reach or withdrawal of one party. Today business needs negotiation mechanism capable of being autonomous and efficient various negotiation mechanisms have been develop to eliminate human involvement from the negotiation aspects of business. However, despite their merit's there are still limitations in their model of negotiation and that require improvement .Most of these is Boolean and don't deal with ambiguity. Another short come is that this mechanism do not provide win situation for both the parties that are buyers and sellers involved in negotiation making a preferable outcome this is not to mention their inability of neither tactics nor strategy to compliment there model. Through this paper we present an negotiation model based on Fuzzy logic (Decision making function) these functions are Rule based, Case based and Bilateral. Considering mainly of initiating offers and counters offers. It is of major importance for a model able to deal with ambiguity and common sense reasoning.

The rest of this paper is as follows:

- Part 2: Investigates related study of negotiation.
- Part 3: Define the proposed model of negotiation.
- Part 4: Advantages.
- Part 5: Conclusion.

2. AUTOMATION OF NGOTIATION SCENARIO

2.1 Overview of related negotiation mechanisms

Negotiation, aims at resolving issues over which have conflicting interest, allocating resources acceptable to both parties. There are various negotiation mechanism such as game theoretic approach, heuristic based negotiation auction based negotiation.

2.1.1 Game theoretic approach:

The game theoretic approach provides very powerful and useful tool for studying and engineering strategy interaction among self interested computational agents in general and to automated negotiation in particular[6] some of the most influential uses of game theory are

- **A domain theory:** it is the work of Rosenschin and Zoltkin [7] domain theory is classified in three domains which emphasize on the study of agents strategy in different domain an under different mechanism.
- **Mechanisms for Combinatorial auction:** The mechanisms Sandholm[8] to construct an electronic commerce server that allocate resources among Multiple agents.

2.1.1.1 Limitation of game theoretic approach:

In game theoretic analysis, researches usually attempt to determine the optimal strategy by analyzing the interaction as a game between identical participants [8]. However, from a

computational perspective, these assumptions are unrealistic about the negotiating software agent.

2.1.2 Heuristic based Negotiation:

Heuristic based Negotiation produce good enough outcomes rather than optimal. The support for a particular heuristic is usually based on empirical testing and evaluation in comparison with other heuristic [9, 10]. In this, instead of exploring all possible deal, agent exchange offers based on heuristic function. Moreover, the author's presents a method that enables an agent to generate offers that are similar to previous offers made by its negotiation counterpart.

2.1.2.1 Limitation of Heuristic based Negotiation:

Model leads to outcomes that are sub optimal that do not examine the full space of possible outcomes.

2.1.3 Auction Based Negotiation:

Auction Based Negotiation presents an effective way for one to one Negotiation. It includes four of single auction which are:

- Ascending bid auction.
- Descending bid auction.
- First price sealed bid auction.
- Second price sealed bid auction.

2.1.3.1 Limitation of auction based negotiation:

Auction based negotiation always and with one sided benefit, always one party wins on the expense of the other. Result from the mathematical analysis of the auction cannot be the best bidding in practice.

3. PROPOSED SYSTEM

Negotiation process means interaction between two parties that have conflicting interest predecessors of such mechanism included agents in their negotiation process but it led to decrease in the cost efficiency as some percentage were to be paid to them proposed a mechanism that we have don't involved any agent in the process of negotiation and it has made this system cost efficient and has avoided human involvement to great extend proposed mechanism make the use of Fuzzy logic to carry outcome negotiation process to ambiguity and make the negotiation a win-win situation for both the parties. Elimination of agents have provided the negotiation process to be carried out directly between the buyer and seller we propose system that can be handled by a single admin and can be used by multi-pal sellers and buyers, who are interested in the particular process of negotiation. Over a common product and have conflicting interest about that product.

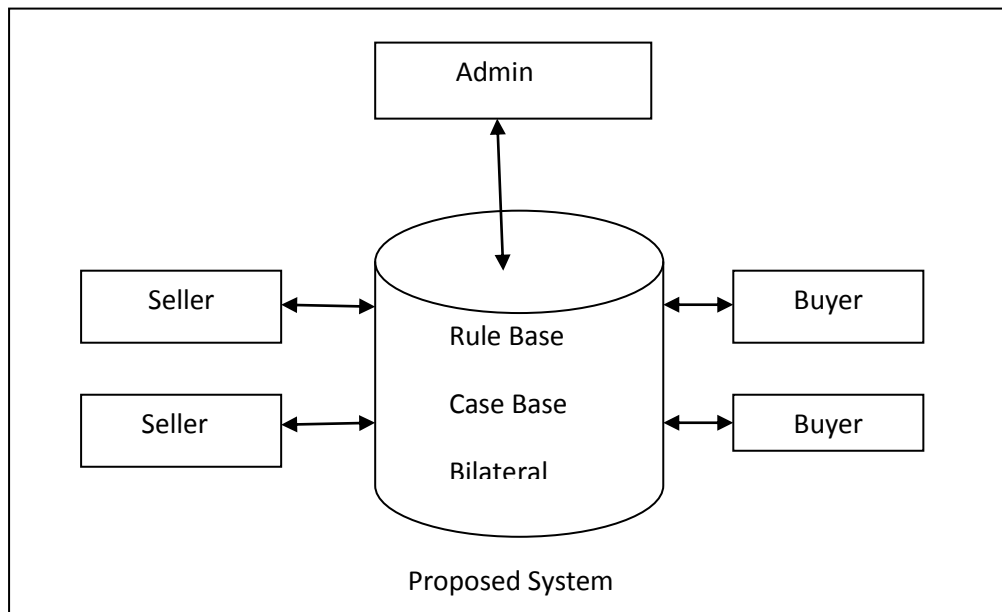


Fig.1: Proposed System

For carrying out the negotiation process using Fuzzy logic we have used three decision making functions.

- Rule base (RB)
- Case base (CB)
- Bilateral (BL)

These three functions make system efficient to carry out various negotiation issues. It creates a negotiation environment favorable for both the parties. Automation of negotiation by using such function and without agents have reduce the human involvement and reduce the time consumption of the negotiation process through emails and meetings as well as made this mechanism cost efficient .

3.1 Working of proposed system

Proposed system handled by administrator who will manage all the offers and counter offers that the sellers needs to sell on the propose system for their buyers. Administrator will place the product and offer on the system with the help of seller as per the introduction of the seller a fixed base amount of a particular product will be provided by the seller to the administrator. This provided value can be the cost price or actual price of the product which is basically expected by the seller.

Another expected price of the same product will be provided by the seller to administrator this price will be the cost price including extra profit and it will be fluctuating and ill the negotiation process will be carried on this expected price provided by the seller. After knowing all the details and both price provided by seller. Administrator will add the product on the system for selling. Now, the buyer can select the product which he wishes to buy and put an expected price that can be negotiated. This expected price will be less than the expected price of the seller. When the system get both the expected price from both seller

as well as buyer the negotiation on both price will start. To carry out negotiation the system will be Fuzzy logic that is Rule base (RB), Case base (CB), Bilateral (BL).

By using this functions negotiation will be carried out and the negotiated price will be provided to buyer and if he confirm negotiation price then a notification will be provided to the seller about the deal otherwise new expected price will be taken from buyer and negotiation can be carried out again on the new expected values until buyer get satisfied or he withdraws and if the negotiated price goes less than the basic price provided by the seller then the process will be discarded and both will be notified about the un cracked deal.

3.2 Rule base negotiation

The first part of the proposed negotiation will be checking for Rule base negotiation. If the product under negotiation matches the rules provided by the seller, then the negotiated price will be provided to the buyer. The rules that can be used by the Seller for the negotiation can be particular Date or time, quantity of product and a particular product. The process for checking the rules provided by seller can be carried out as follows:

Algorithm:

Where,

ND=Negotiation Date, OD=Offer Date.

NQ=Negotiation quantity, OQ=Offer quantity.

NP=Negotiation product, OP=Offer product.

If (ND=OD)

{

Then provide negotiated price to the buyer.

} else

 If (NQ=OQ)

 {

 Then provide negotiated price to the buyer.

 } else

 If (NP=OP)

 {

 Provide negotiated price to the buyer.

 } else

 Check for case base negotiation.

If the negotiation is carried out on the same date provided by the seller for an offer or discount, then the buyer will be provided with the discounted price. If the negotiation date does not match with the offer date, then the negotiation product will be checked for its

quantity. If the product under negotiation matches the quantity provided by the seller for an offer then the buyer will be provided with the discounted amount. If the product does not matches the quantity rule, then it will be checked for its specific product rule, if the product is same for which the seller has put an offer, then discount will be provided. If all the rules of rule base negotiation are not satisfied then the negotiation product will be checked for case base negotiation.

3.3 Case base negotiation

The product that does not match the rules of the Rule base negotiation will be checked for case base negotiation. Case based negotiation will be for the products which have already undergone negotiation process. The product will be checked for its previous negotiation, if the product has its previous negotiated price, then the price will be displayed to the buyer. If the product is not been negotiated previously, then it will be send to next negotiation process i.e. bilateral negotiation.

3.4 Bilateral Negotiation

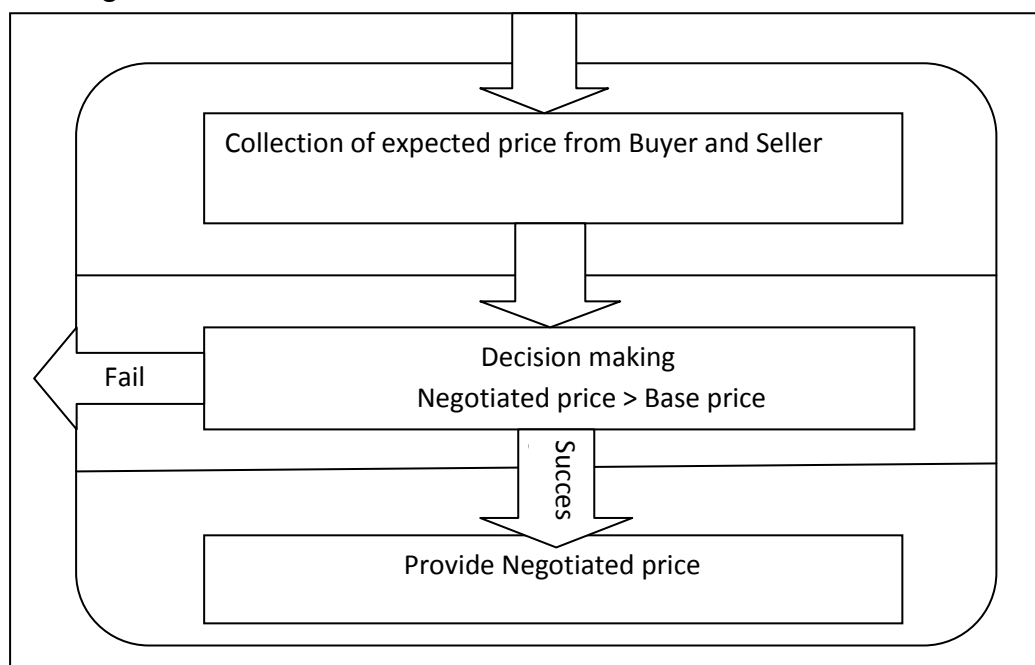


Fig.2: Bilateral Negotiation Process

The product under negotiation that does not fits in Rule base and Case base negotiation will be carried forwards to bilateral negotiation. In Bilateral negotiation actual negotiation on the price provided by the seller and buyer will be done. Two prices will be provided by the seller, Base price (which will be the cost price of product or the real expected price) and the second, expected price (Which will be the price including more profit). Buyer will provide the expected price for the product after watching the Sellers expected price and the negotiation will be carried on the expected price provided by both buyer and seller.

First the expected price provide by the buyer will be checked if the expected price is less than the base price provided by the seller the negotiation will be discarded. If the expected price of the buyer is greater than the base price then negotiation will be carried out. Negotiated price will be found as follows:

$$\text{Negotiated price} = (E_s + E_b) / 2.$$

Where,

E_s is expected price of seller.

E_b is expected price of buyer.

After finding the negotiated price, this price will be checked for its correctness. The negotiated price should be greater than the base price. If it is less than the base price the negotiation process will be stopped and the buyer will be expected to enter greater price than previously entered expected price. If the negotiated price is greater than the base price then it will be shown to the buyer and if that price is accepted by buyer then the deal can be done by the buyer and seller.

4. ADVANTAGES

The Proposed system eliminates agents in the negotiation process, thus makes the system cost efficient. Human involvement has been reduced in the process of negotiation, so it will save time that was required for negotiation through Emails, meetings etc. Proposed system can deal with ambiguities and common sense reasoning. Negotiation done by using these decision functions creates the win-win situation for both buyer as well as seller.

5. CONCLUSION

This paper proposes a fuzzy logic based negotiation modeling used to overcome the complexity of negotiation process for automation. The reasoning model of negotiation has been implemented and is based on realistic assumption suitable for automation. This is done in an effort to model the negotiation toward human like negotiation. In this work we have used simplest format to keep our model easy and to focus more on the concept of negotiation using fuzzy value.

6. FUTURE SCOPE

The proposed system can be made more secure in future and it can be placed on clouds and can be used on various distributed systems. In this work we have used simplest format to keep our model easy and to focus more on the concept of negotiation. Hence, there are many open questions which constitute the object of future work.

ACKNOWLEDGEMENT

We would like to express our gratitude towards Prof. R.N.Phursule, our guide, for his immense support and encouragement. We are also thankful to our department for providing necessary resources.

REFERENCES

- [1]. N. R. Jennings, P. Faratin, A. R. Lomuscio, S. Parsons, C. Sierra, and M. Wooldridge. Automated negotiation:prospects, methods and challenges. In! J. of Group Decision and Negotiation, 10(2): 199-215, 2002.
- [2]. F. Sadri, F. Toni, and P. Torroni. Abductive logic programming architecture for negotiating agents. In

Proceedings of the 8th European Conference on Logics in Artificial Intelligence (JELIA 2002), volume 2424 of Lecture Notes in Computer Science, pages 419--431. Springer, 2002.

- [3]. I. Rahwan, L. Sonenberg, N.R. Jennings, P. McBurney, *Stratum: A methodology for designing agent negotiation strategies*, *Applied Artificial Intelligence* 21 (10) (2007).
- [4]. Ramchurn, C. Sierra, L. Godo, N.R. Jennings, *Negotiating using rewards*, in: *Proceedings of the Fifth International Joint Conference on Autonomous Agents and Multi-Agent Systems*, ACM Press, 2006, pp. 400--407.
- [5]. I. Rahwan, L. Sonenberg, F. Dignum, *Towards interestbased negotiation*, in: I.S. Rosenschein, T. Sandholm, M. Wooldridge, M. Yokoo (Eds.), *Proceedings of the 2nd International Joint Conference on Autonomous Agents and Multi-Agent Systems*, Melbourne, Australia, 2003, pp. 773-780. 867.
- [6]. K. Binmore and N. Vulkan. *Applying game theory to automated negotiation*. In *Proceedings of the DIMACS workshop on economics, game theory' and the Internet*, New Brunswick NJ, USA, April 1997. Rutgers University.
- [7]. J. Rosenschein and G. Zlotkin. *Rules of Encounter: Designing Conventions for Automated Negotiation among Computers*. MIT Press, Cambridge MA, USA, 1994.
- [8]. K. Larson and T. Sandholm. *An alternating offers bargaining model for computationally limited agents*. In C.Castelfranchi and L. Johnson, editors, *Proceedmgs of the 1 st International Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS-2002)*, pages 135-142,2002.
- [9]. C. Sierra, P. Faratin, and N. R. Jennings. *A serviceoriented negotiation model between autonomous agents*. In *Proceedings of the 8th European Workshop on Modeling Autonomous Agents in a Multi-Agent World (MAAMAW-1991)*, pages 17-35, Ronneby, Sweden, 1997.