

# Analysis Of Software Requirement Analysis In Software Development Process Using Intelligent Agent With Intuitionistic Fuzzy Analytical Hierarchical Process

S. Muthuselvan, K. Somasundaram, S. Rajaprakash

**Abstract:** Software development is one of the significant and necessary profession in the global scenarios. All the fields in the world like finance, transport, education, design, government and private sectors of the professions using software day to day life. In this, software development process contain the different type of process for meet the client requirements. For the competency of the competitors, it is very difficult to retain the clients. It will create the uncertainty of the software field, also, it will create the multi criteria decision making issues. To overcome the above issue, in this work, will identify the important attributes from the software requirement analysis phase with the help. Applying the intelligent agent system for allocation of the survey and receiving the opinion through the questionnaire generated by the intelligent agent.

**Index Terms:** Software development process, intelligent agent, Fuzzy, Analytical Hierarchy Process, Software Requirement Analysis.

## 1. INTRODUCTION

THE software development industry is one of the developing and evolving field among the world. The new software makes us to live new life and more contented. Now a day, computers are indispensable in the global, because of their extensive usage of the all fields in the world. This is widely used to industries, Engineering, medicine fields, commerce area, education, agriculture and so on. The history of the software industry starts from the 1960's and evaluated very fast and widespread quickly. [5] Software development life cycle (SDLC) is the important role for the quality of the software. SDLC gives the high level quality software to developer for exceed or meet their client requirements. It helps the developer to complete their project with in the stipulated time frame and it is straightly associated with the satisfaction of the customer as well as the organization [5]. There is several models available for the software development in the field. Most of the models have different phases to complete their project. Among the existing models, waterfalls model is the one of the older as well as the significant and furthest generally used model. The creation of programming frameworks is probably the best challenge confronting programming engineers at all degrees of the improvement cycle. Most prerequisites determination devices are more appropriate for practical necessities than for non-useful necessities. Prerequisites are left vague, indicated at a later stage, or, best case scenario enigmatically determined, which makes necessities particulars a greater amount of a workmanship than a science. Indeed, even the test for execution is regularly remaining burden subordinate and in that capacity the presentation numbers gave at test time or at framework charging time may not be feasible during genuine framework outstanding task at hand. What makes the topic

increasingly troublesome is the nonappearance of an unmistakable arrangement of guidelines or practices, which, whenever pursued intently. [16]

### 1.1 Software Development Issues and Challenges

Involving the series of process together important for completing the projects successfully. Inside the process all the stages is important to getting done in each stage. If any issues raised in the software development, immediate changes to be done on the code based on the situation for competing the project. Managing the software development team is very complex and challenging one in now a day. Human resources of the particular project may be distributed in different places and coordinating and achieve the client requirement is very difficult. At this situation, distributed resources in a team should work in a parallel manner [6]. Another issues in the software development process is to communicating among all the team members. The miscommunication will lead the team to poor quality of the product as well as the extension of the time to complete the project. The expense of the project will increased with the lack of meeting the customer expectation. Time scheduling of the project will be the important issues and challenges of the software development process. All the clients will expect to complete the project as much as fast and deploy into their environment. If it is the poor time allocation for completing the project will lead the not meeting the customer expectations. [8]. Based on the observation it would have been identified that in which area concentrate more for giving preference to retain the client.

### 1.2 Intelligent Agents (IA)

An Intelligent agent is whatever can be perceived as, seeing its condition through sensors and succeeding up on that condition through actuators. Intelligent agents are frequently portrayed schematically as a conceptual practical framework like a PC program. Therefore, intelligent agents are at times called abstract intelligent agents (AIA) to recognize them from their certifiable executions as PC frameworks, natural frameworks, or associations. A few meanings of intelligent agents are underline their self-governance, thus favor the term autonomous intelligent agents.

- S. Muthuselvan, Research Scholar, St. Peter's Institute of Higher Education and Research, Avadi, Chennai, Tamil Nadu 600054, Chennai, India, ORCID: 0000-0002-1923-3600, csmuthuselvan@gmail.com.
- Dr. K. Somasundaram, Chennai Institute of Technology, Chennai, India, soms72@yahoo.com.
- S. Rajaprakash, Aarupadai Veedu Institute of Technology, Chennai, India, ORCID: 0000-0003-2237-5850,

### 1.3 Software Agent (SA)

A software agent is a bit of programming that capacities as an agent for a client or another program, working self-sufficiently and ceaselessly in a specific situation. It is hindered by different procedures and specialists, but at the same time can gain from its involvement in working in a situation over an extensive stretch of time.

The following factors characterized the software agents, [21]

1. Each agent only has incomplete information or capabilities for solving the problem, as it is only capable of perceiving part of the problem space or part of its environment (locality).
2. To control the system globally is not available.
3. Decentralized data is using here.
4. Asynchronous Computation is followed.

Computers are not accurately skilled at recognizing what to do: each activity a computer performs must be expressly envisioned, made arrangements for, and coded by a software engineer. In the event that a computer program or software ever experiences a circumstance that its creator didn't envision, at that point the outcome isn't normally pretty - a framework crash, best case scenario, numerous death toll at the very least. This ordinary truth is at the core of our association with PCs. It is so undeniable to the PC proficient that it is once in a while referenced. But it comes as a total astonishment to those experiencing PCs just because. Generally, we are glad to acknowledge PCs as respectful, exacting, dull workers. For some applications, (for example, finance handling), it is completely satisfactory. Be that as it may, for an inexorably enormous number of uses, we require frameworks that can choose for themselves what they have to do so as to fulfill their plan destinations. Such PC frameworks are known as specialists. Operators that must work vigorously in quickly evolving, eccentric, or open situations, where there is a huge probability that activities can fall flat are known as intelligent agent, or in some cases called autonomous agent. [11]

### 1.4 Fuzzy Set

During the uncertain situation at the time of decision making Fuzzy set played the vital role. Fuzzy set concept applied successfully in different applications in real world scenario in terms of direct or indirect. The Intuitionistic Fuzzy Set (IFS) theory is generalized from the fuzzy set theory [1]. The sum of the membership function and the non-membership function should not be exceeded one. From the observation, the fuzzy sets are Intuitionistic Fuzzy set, but it is not necessary it's contrary [2].

### 1.5 Intuitionistic Fuzzy Set

Definition 1.2.1

Let A be an Intuitionistic fuzzy set (IFS) and F is an object defined in the following form [10]

$$A = \{(x, \mu_A(x), \nu_A(x)) | x \in F\} \quad (1)$$

where the functions:

$$\mu_A: F \rightarrow [0, 1]$$

and

$$\nu_A: F \rightarrow [0, 1]$$

define the degree of member and the degree of non-membership of the element  $x \in F$ , respectively, and for every  $x \in F$ .

$$0 \leq \mu_A(x) + \nu_A(x) \leq 1 \quad (2)$$

Obviously each ordinary fuzzy set may be written as

$$\{(x, \mu_A(x), 1 - \nu_A(x)) | x \in F\} \quad (3)$$

### 1.5 Analytical Hierarchy Process (AHP)

Saaty developed the concepts called Analytical Hierarchy Process in the year of 1984, it is the techniques for analysis the system and it is used solving the decision making problems. Here problems will be divided into simple problems from the entire problems. This techniques is very dominant multiple criteria decision making, which is used to answer the decision making problems for the different attributes. It is fully depends on the assumption of the decision makers or experts of particular attribute for dealing with the qualitative criteria. The linguistics representation given in the below table 1. The quality of the comparison is affected based on the decision maker's knowledge [12] [3]. In AHP, the values are only crisp values, it will not reflect the exact1 output of the problem. So, Fuzzy Analytical Hierarchy Process introduced by P.J.M.van Laarhoven et. al. [19].

NUMBER VALUES	LINGUISTICS SCALE	EXPLANATION
1	Same Equal reputation of both elements	Both elements contribute similarly
3	Modest rank of one element over another	Experience and judgement favor one element over another
5	Strong importance one element over another	An element is very strongly dominant
7	Very strong importance of one element over another	An element is favored by at least an order of magnitude
9	Extreme importance of one element over another	An element is favored by at least more than an order of magnitude
2,4,6,8	Middle values	Used to conciliation between decision

*Table 1 Comparative importance scale*

### 1.6 Fuzzy Analytical Hierarchy Process (FAHP)

The combination of Analytical Hierarchy Process and the Fuzzy set theory is called Fuzzy Analytical Hierarchy Process. In AHP comparison matrix, values are converted into fuzzy set using the membership functions. In FAHP, if the value existing other than the membership function then the value not reflect the output of the problem. To overcome this issue Intuitionistic Fuzzy Analytical Hierarchy Process (IFAHP) was introduced by the Krassimir T.Atanassov [20].

### 1.7 Intuitionistic Fuzzy Analytical Hierarchy Process (IFAHP)

The more composite or complex problems in decision making can be handled with the help of the Intuitionistic Fuzzy Hierarchy Process [22]. The decision makers will have ambiguity in transmission the preference values to the objects, in this situation IFAHP will be the best option for handle the situation in best manner [4].

## 2. PAST WORK

In this volume we endeavor to investigate India's software product industry. As opposed to expect that the fast development of programming fares is a certain indication of the division's quality or that fares will fundamentally take care of India's improvement issues, we basically inspect the Indian programming industry. This was provoked by three perceptible highlights of the Indian programming industry: first, for all the

promotion of fast sectoral extension, the Indian business has involved a peripheral situation on the planet showcase; second, despite high development rates, India's fares have been to a great extent low worth yield; and third, the size of the household market is not exactly 33% of India's fare advertise. These qualities request a closer assessment of the business to distinguish the wellsprings of development, the specific boundaries confronting it, and the conceivable key and approach reactions that could raise the Indian business to a higher direction. To achieve this the business must continue its high development rate for a long time to come and, relatedly, must climb the worth chain to get such high development. Thusly, a significant part of the positive thinking in regards to the area's transformative capacity on the Indian economy depends on the business' capacity to advance and adapt to new rivals in a quickly changing worldwide data and interchanges innovation condition. [8]

## 2.1 Literature Survey

The combination of the Delphi method and the Intuitionistic Fuzzy Analytical Hierarchy Process implemented in the automobiles sector. For the successful implementation author received the opinion form the experts from the automobile industry. Author used the IFAHP, for overcome the issue of ambiguity and the indecision. After the formation of the questionnaire, it sent to the author using the SurveyMonkey.com for the survey. [7] Evaluation is implemented for two different practical case studies for detection of the failure with the help of the two different case studies. The output of the two different case studies or samples are associated with the computational methods like IWF-TOPSIS and IFH-TOPSIS. At last the ranking of the attribute performed with our traditional priority numbering. [13] Assessment on Human Capital (HC) advancement and a learning based economy turns out to be progressively significant as a few methodologies have been proposed. One of the well-known strategies in multi criteria assessment is the pair-wise correlation of Analytic Hierarchy Process (AHP). This investigation means to rank human capital pointers utilizing a hybridization of the AHP and two-sided assessment in Intuitionistic Fuzzy Sets (IFS). The new Intuitionistic Fuzzy Analytic Hierarchy Process (IFAHP) is utilized to assess the four primary pointers of HC. The IFAHP approach estimates markers of HC by considering positive traits and negative characteristics of HC pointers simultaneously through master decisions. A fourteen things survey was utilized to inspire phonetic information from three specialists in the field of HC the executives. Etymological decisions of the pointers in pair-wise examination assessment are registered utilizing the five stage calculation of the IFAHP approach. The outcomes demonstrate that the making result by utilizing learning is the most elevated in the positioning. Of the four markers, Employee's Skill Index is the most reduced in the positioning. The positioning most likely mirrors the significance of the pointers in overseeing HC particularly in Malaysian ventures. [14] Software Process Improvement (SPI) is one of the principle programming advancement challenges. Notwithstanding, SPI gauges and models (CMMI, SPICE) have not been constantly received with progress. The present issue is an absence of procedure to execute effectively these measures and models. To embrace this goal is basic watch genuine encounters and identify procedure and undertaking common connections. Without this arrangement it won't be

conceivable to discover how procedure the executives is extremely critical to accomplish association's key targets. [15] Business scorecard is a fundamental piece of human asset the executives in an industry or an association and used to fortify the usefulness of the association. It assumes a fundamental job in advancing the business. Investigating the vulnerability sneaking into different factors in business scorecard is a fascinating test. In this work, we applied Intuitionistic Fuzzy Analytical Hierarchy Process (IFAHP) with Fuzzy Delphi strategy to investigate the vulnerability factors in business scorecard. Likewise we investigate the significance of different factors by methods for positioning utilizing IFAHP with Fuzzy Delphi strategy. The positioning scores are additionally used to reinforce the business scorecard. [18]

## 3. METHODOLOGY

Step 1:

1. Author send the inputs of number of attributes and the number of experts in the industry using the Intelligent Agents.
2. Intelligent Agent will be used to frame the Questionnaires with the existing attributes.
3. Questionnaires are allocated to the experts in the industry by Intelligent Agent through the web portal.
4. Based on the time bound and response from the experts the intelligent agent will received or recall the questionnaires. If it is recalled by the agent, then questionnaire will be assigned to other experts which is available.

Step 2:

1. Based on the agent input, using online survey portal, expert's opinions are received. In this work ten experts are finalized for the survey.
2. Using the membership function and non-membership function  $\mu$  and  $\nu$  are calculated.

Step 3: Comparison Matrix

Formation of comparison matrix can be achieved from the finalized values in step-2.

Step 4: Intuitionistic Preference Relation

Consistency checking carried out with the help of the intuitionistic preference relation [17] by the indication of Xu et al. the consistent interval fuzzy preference is as follows.

$R = (M_{xy})_{n \times n}$  with  $M_{xy} = (\mu_{xy}, \nu_{xy})$  ( $x, y = 1, 2, 3, \dots, n$ ) is multiplicative consistent,

$$\text{If, } \mu_{xy} = \begin{cases} 0, & \text{if } (\mu_{xp}, \mu_{py}) \in \{(0,1), (1,0)\} \\ \frac{\mu_{xp}\mu_{py}}{\mu_{xp}\mu_{py} + (1-\mu_{xp})(1-\mu_{py})}, & \text{otherwise} \end{cases} \quad (4)$$

$$\nu_{xy} = \begin{cases} 0, & \text{if } (\nu_{xp}, \nu_{py}) \in \{(0,1), (1,0)\} \\ \frac{\nu_{xp}\nu_{py}}{\nu_{xp}\nu_{py} + (1-\nu_{xp})(1-\nu_{py})}, & \text{otherwise} \end{cases} \quad (5)$$

The relationship of fuzzy preference have authenticated by Xu and Xia.

Theorem: [Xe et.al] in the fuzzy preference relation the following statement are equivalent:

$$b_{xy} = \frac{\sqrt[n]{\prod_{r=1}^n b_{M_r} b_{r_y}}}{\sqrt[n]{\prod_{r=1}^n b_{M_r} b_{r_y} + \sqrt[n]{\prod_{r=1}^n (1-b_{M_r})(1-b_{r_y})}} \quad x, y = 1, 2, 3 \dots n \tag{6}$$

Created on the above outcome and theorem of Zeshuri Xu et.al in the “intuitionistic fuzzy analytic hierarchy process” established two algorithms. But used merely one algorithm. The following formula derived based on this algorithm.

For  $y > x + 1$ , and let  $\bar{M}_{xy} = (\bar{\mu}_{xy}, \bar{\nu}_{xy})$  where

$$\bar{\mu}_{xy} = \frac{\sqrt[n]{\prod_{i=x+1}^{y-1} \mu_{xp} \mu_{py}}}{\sqrt[n]{\prod_{p=x+1}^{k-1} \mu_{xp} \mu_{pk} + \sqrt[n]{\prod_{p=i+1}^{y-1} (1-\mu_{xp})(1-\mu_{py})}}} \quad y > x + 1 \tag{7}$$

$$\bar{\nu}_{xy} = \frac{\sqrt[n]{\prod_{i=x+1}^{y-1} \nu_{xp} \nu_{py}}}{\sqrt[n]{\prod_{p=x+1}^{k-1} \nu_{xp} \nu_{pk} + \sqrt[n]{\prod_{p=i+1}^{y-1} (1-\nu_{xp})(1-\nu_{py})}}} \quad y > x + 1 \tag{8}$$

And for  $y = x + 1$  let  $\bar{M}_{xy} = M_{xy}$  and  $y < x$  let  $\bar{M}_{xy} = (\bar{\nu}_{yx}, \bar{\mu}_{yx})$

From the Multiplicative consistent intuitionistic relation is obtained from the above Equations, the lower triangular elements of the matrix.

Step 5: Consistence Check

With the help of the below formula, the distance among the intuitionistic relations calculated [4].

$$d(\bar{M}, M) = \frac{1}{2(n-1)(n-2)} \sum_{i=1}^n \sum_{j=i+1}^n (|\bar{\mu}_{ij} - \mu_{ij}| + |\bar{\nu}_{ij} - \nu_{ij}| + |\bar{\pi}_{ij} - \pi_{ij}|) \tag{7}$$

$$d(\bar{M}, M) < \tau \tag{8}$$

If the Equation 8 then the relation matrix is consistent in the intuitionistic relation. Here  $\tau$  is the threshold for the consistency. If the Equation 8 is not satisfied then intuitionistic preference relation is not consistent then go to the step1

Step 6: Weight Calculation

The importance of the intuitionistic preference relation is designed by using the following [4].

$$w_x = \frac{\sum_{y=1}^n M_{xy}^1}{\sum_{x=1}^n \sum_{y=1}^n M_{xy}^1} = \frac{\sum_{y=1}^n [\mu_{xy}, 1 - \nu_{xy}]}{\sum_{x=1}^n \sum_{y=1}^n [\mu_{xy}, 1 - \nu_{xy}]} \tag{9}$$

$$w_x = \left( \frac{\sum_{y=1}^n [\mu_{xy}]}{\sum_{x=1}^n \sum_{y=1}^n [1 - \nu_{xy}]}, 1 - \frac{\sum_{y=1}^n [1 - \nu_{xy}]}{\sum_{x=1}^n \sum_{y=1}^n [\mu_{xy}]} \right) \tag{10}$$

According to the Szmidt and Kacprzyk a function in mathematical form

$$\rho(\alpha) = 0.5(1 + \pi_\alpha)(1 + \mu_\alpha) \tag{11}$$

Step 7: Preference Ranking

$\rho(\alpha)$  is calculated with the help of the equation (3.8) after derived the weight of the equation (3.8). Using  $\rho(\alpha)$  value, the

order of the preference attributes (Rank) will be found.

3.1 Architecture Diagram

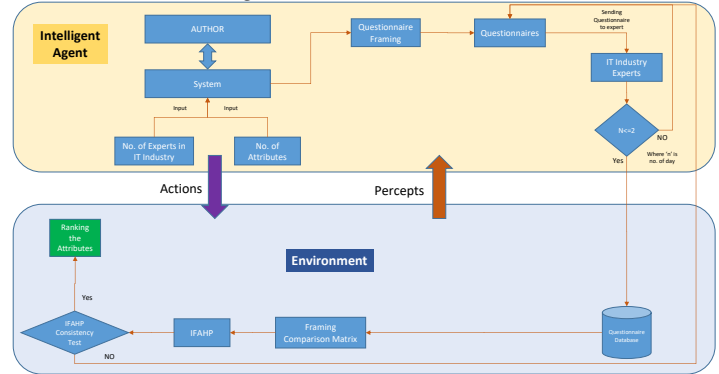


Fig. 1. Architecture Flow Diagram

Author send the details about the number of attributes selected for the work and the number of software developer identified for sending the survey for getting the input from the experts. Intelligent Agent will frame the questionnaires for getting the input from the experts. After finalized the questionnaire, it will be sent to the experts to get the opinion from them. If the experts not replied with in the time limit assigned by agent, again questionnaire will be allocated to some other experts, If the experts given their opinion, it will be saved in the database system. Data will be taken for preprocessed to the Fuzzy Delphi Method. After processed the data, it will be go for framing the comparison matrix. Otherwise, questionnaire will be sent again to the experts and get the opinion from them. After frame the comparison matrix, it will be used for Intuitionistic Fuzzy Analytical Hierarchy Process. Completion of the IF-AHP or findings of the ranking will be tested for IF-AHP consistency test. If the test is failed, it will be moved to the questionnaire. Once the consistency test is pass, the attributes will the ranked as per the hierarchy.

3.4 IF-AHP Flow Diagram

The below above figure 2, shows the IF-AHP flow diagram. Identifying the problem is the initial process of this work. In this paper, selected the software development process. Need to be identified or ranking the important attribute of the software development process. Experts' identification is the next step of the process of this IF-AHP. Hierarchy will be identified from the existing attributes. Framed hierarchy will be moved to framing the comparison matrix. Comparison matrix will be checked for the consistency. If it is consistency test is pass, it will be moved to find the priority. The highest hierarchy will be the highest rank among the all attributes.

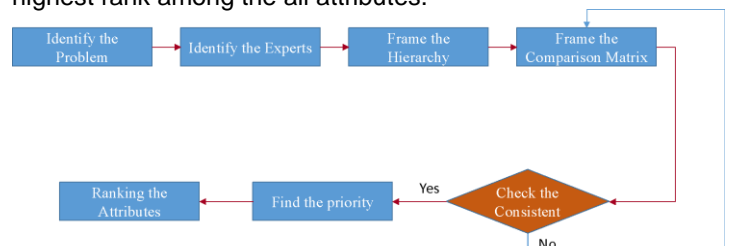


Figure 2. IF-AHP Flow Diagram

4. IMPLEMENTATION

Software development process is the sequence of the process with the dependence of the lots of small process. Completion of the software development based on the client requirement



is the complex in many ways. In this paper, attributes will be ranked based on the industry experts. Initially, 15 experts are identified for getting the suggestion about the attributes selections. Among these all experts, finalized only ten experts for implementation. Suggestions are received from the experts and framed the hierarchy among the attribute from the all phases of the software development process. Observations about the work represented in the chapter 5. Every phases of the software development process involved all these processes.

## 5 OBSERVATION FROM THE EXPERT

### 5.1 Initialization of the Project

Software Develop Process contain the series of process to be accomplished its entire development. Initialization is the primary and basic steps to start a new project with the current scenario in the company and the software development industry for the purpose of improving the company's growth and profit. The higher level management people will kick of this process for the future of the company.

### 5.2 Tender Searching

Tender searching is to find the software projects which is available in the industry to do the company based on the requirement given by the clients. Tender searching can be achieved with the help of the team which is available in the company for getting/applying for the tenders. It can be done with the help of registering the company standards and capacity in the available web portal available in the markets. The few leading IT tender portals are as follows  
www.tender247.com, www.ittenders.com,  
www.tendertiger.co.in.

### 5.3 Identify the tender

At the time of searching tender, projects can be identified by the marketing team based on the availability of infrastructure of the company and the skilled resource person for completing the projects. Suitable few projects can be identified and applied for getting the tender by the expert team which is available in the company.

### 5.4 Request for Proposal (RFP)

Request for Proposal (RFP) document, which contains the proposal to vendor to applying the bid to get the project from the private or government organization. The document will contain the actual appeal of proposals to the vendors, it may be private or government. RFP will be sent to all the interested vendors, those who expecting the IT solutions for their requirements. This document will contain the execution of the service and the list of the works to be done by the IT Company.

### 5.5 Open Tender (By Client)

After distribution of the RFP to all interested vendors, tender will be opened after the discussion with the IT companies by one to one review about the company. During the tender opening phase client will check companies which will be fulfill their requirements as well as the maintenance capabilities for the full duration.

### 5.6 Awarded the Tender

Tender will be awarded for the suitable company after they

accept and understand the terms and conditions of the clients for kick of their project implementation. In this conditions and the terms are very important in the term of payments. Sometimes the payment cannot be done, even the job is completed or delivered the product.

### 5.7 Requirement given by Client

Client will give their requirements to the companies as per the format accepted by the both parties, which is mentioned in the tender documents. It will cover entire requirements of the clients based on their final production assumptions. Requirements may be changed during the software development process. It will be resolved based on mutual agreement between the client and the company.

### 5.8 Requirement freeze with Client

After discussion with the higher level people, the requirements will be finalized with the clients. If there is any difficulty or implementation impossible with the requirements, it will be discussed with the client, before freeze the requirement.

### 5.9 Statement of Work (SoW)

The Statement of Work will be prepared, after freezing the requirements with the clients. The statement of work will be described about the overall features of the project. The statement of the work will be the initial document for the overall projects. This will be split into small parts of the projects.

### 5.10 Finalizing s/w, tool, procurements, Estimation (coding, testing, project management, client interaction)

The important level of the requirement analysis will be finalizing the software to be used for the entire projects, tools, procurement of the project and cost estimation of the project for all the level of the projects. So that, the planning of the project development will be implemented into the proper manner.

### 5.11 Quotes conversion to dollars

This is stage to convert the quotes proposed to client will be changed into the dollar's value. The cost of the projects may be in any value of currencies. But it will be converted into the dollars. It may be client expectations to know about the value of exact project for completing it.

### 5.11 Modules wise requirement

Overall requirements will be allocated to all the modules of the projects. So that the resources, time duration of completing the modules can be identified. The module wise requirements will be used to help the developers to complete the project with in the stipulated time allocated duration.

### 5.12 Requirement freeze

This level of Software development is internal requirement freeze. This will be helpful to decided required resources, hours to be worked on the particular module, money to be spent for the particular module/project completion. So that the project will be completed with the quality and it will be deployed to the client location.

### 5.13 Attributes Representation

Software Development Process contain the more number of

attributes. All the attributes are divided into different phases. Among all these phases, this paper will implement the "Software Requirement Analysis (SRA). The following attributes are selected for implanting the SRA using IFAH. The attributes are as follows. Tender Searching(R1), Identify the tender(R2), Request for Proposal (RFP)(R3), Open Tender (By Client)(R4), Awarded the Tender(R5), Requirement given by Client(R6), Requirement freeze with Client(R7), Statement of Work(SoW)(R8), Finalizing H/W, S/W & all others(R9), Quotes conversion to dollars(R10), Modules wise requirement(R11). Attributes are donated the variable, these variables are given at the end of the attribute name with the brackets. Here, attributes are selected based on the important of the phase is software requirement analysis.

Based on the survey from the software industry experts, the comparison matrix 'I' framed, which is given below

$$I = \begin{bmatrix} (0.5,0.5) & (0.4,0.5) & (0.4,0.5) & (0.5,0.5) & (0.4,0.5) & (0.4,0.5) & (0.4,0.5) & (0.4,0.5) & (0.4,0.5) & (0.4,0.5) & (0.4,0.5) \\ (0.5,0.4) & (0.5,0.5) & (0.4,0.5) & (0.4,0.33) & (0.4,0.5) & (0.4,0.5) & (0.4,0.5) & (0.4,0.5) & (0.4,0.5) & (0.4,0.5) & (0.4,0.5) \\ (0.5,0.4) & (0.5,0.4) & (0.5,0.5) & (0.4,0.5) & (0.4,0.5) & (0.4,0.5) & (0.5,0.5) & (0.4,0.5) & (0.4,0.5) & (0.4,0.5) & (0.5,0.5) \\ (0.5,0.5) & (0.33,0.4) & (0.5,0.4) & (0.5,0.5) & (0.4,0.5) & (0.4,0.5) & (0.5,0.5) & (0.4,0.5) & (0.4,0.5) & (0.4,0.5) & (0.4,0.5) \\ (0.5,0.4) & (0.5,0.4) & (0.5,0.4) & (0.5,0.4) & (0.5,0.5) & (0.4,0.5) & (0.5,0.4) & (0.4,0.5) & (0.5,0.5) & (0.5,0.5) & (0.5,0.5) \\ (0.5,0.4) & (0.5,0.4) & (0.5,0.4) & (0.5,0.4) & (0.5,0.4) & (0.5,0.5) & (0.5,0.5) & (0.5,0.4) & (0.4,0.5) & (0.4,0.5) & (0.4,0.5) \\ (0.5,0.4) & (0.5,0.4) & (0.5,0.4) & (0.5,0.4) & (0.5,0.4) & (0.4,0.5) & (0.5,0.4) & (0.5,0.5) & (0.4,0.5) & (0.4,0.5) & (0.4,0.5) \\ (0.5,0.4) & (0.5,0.4) & (0.5,0.4) & (0.5,0.5) & (0.5,0.5) & (0.33,0.4) & (0.5,0.4) & (0.5,0.4) & (0.5,0.5) & (0.5,0.5) & (0.4,0.5) \\ (0.5,0.4) & (0.5,0.4) & (0.5,0.4) & (0.5,0.4) & (0.5,0.5) & (0.4,0.5) & (0.5,0.4) & (0.5,0.4) & (0.5,0.4) & (0.5,0.4) & (0.5,0.5) \\ (0.5,0.4) & (0.5,0.4) & (0.5,0.4) & (0.4,0.4) & (0.5,0.5) & (0.33,0.4) & (0.5,0.4) & (0.5,0.4) & (0.4,0.5) & (0.4,0.5) & (0.5,0.4) \end{bmatrix}$$

Fig. 3 Framing of comparison matrix I

To check the consistency of the framed matrix I[4] framing  $\bar{I}$  using equation (4) and (5) the following Consistency Matrix formed

Using the above equations (6) and (7), the consistency matrix  $\bar{I}$  created as follow

$\bar{I}$	Q1		Q2		Q3		Q4		Q5		Q6		Q7		Q8		Q9		Q10		Q11		
	$\mu$	$\nu$	$\mu$	$\nu$	$\mu$	$\nu$	$\mu$	$\nu$	$\mu$	$\nu$	$\mu$	$\nu$	$\mu$	$\nu$	$\mu$	$\nu$	$\mu$	$\nu$	$\mu$	$\nu$	$\mu$	$\nu$	
Q 1	0.5	0.5	0.4	0.5	0.4	0.5	0.3	0.5	0.2	0.5	0.1	0.5	0.2	0.5	0.1	0.5	0.0	0.1	0.0	0.5	0.0	0.2	0.2
Q 2	0.5	0.4	0.5	0.5	0.4	0.5	0.4	0.4	0.3	0.5	0.2	0.4	0.2	0.3	0.1	0.3	0.0	0.3	0.0	0.4	0.0	0.2	0.2
Q 3	0.5	0.4	0.5	0.4	0.5	0.5	0.4	0.5	0.5	0.5	0.4	0.5	0.3	0.4	0.3	0.4	0.2	0.4	0.1	0.5	0.1	0.4	0.4
Q 4	0.5	0.3	0.4	0.4	0.5	0.4	0.5	0.5	0.5	0.5	0.4	0.5	0.3	0.4	0.3	0.4	0.2	0.4	0.1	0.5	0.1	0.4	0.4
Q 5	0.5	0.2	0.5	0.3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.5	0.2	0.4	0.1	0.5	0.1	0.4	0.4
Q 6	0.5	0.1	0.4	0.2	0.5	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.5	0.4	0.4	0.4	0.3	0.3	0.2	0.3	0.3
Q 7	0.5	0.2	0.3	0.2	0.3	0.4	0.4	0.3	0.4	0.4	0.5	0.4	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.5	0.2	0.4	0.4
Q 8	0.5	0.1	0.3	0.1	0.4	0.3	0.4	0.3	0.4	0.5	0.4	0.5	0.5	0.4	0.5	0.5	0.4	0.5	0.4	0.5	0.3	0.5	0.5
Q 9	0.1	0.0	0.3	0.0	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.4	0.4	0.4	0.5	0.4	0.5	0.5	0.4	0.5	0.4	0.5	0.5
Q 10	0.5	0.0	0.4	0.0	0.5	0.1	0.5	0.1	0.5	0.1	0.3	0.3	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.5	0.4	0.5	0.5
Q 11	0.2	0.0	0.2	0.0	0.4	0.1	0.4	0.1	0.4	0.1	0.3	0.2	0.4	0.2	0.5	0.3	0.5	0.4	0.5	0.4	0.5	0.5	0.5

Table 1 Values of the  $\bar{I}$  bar values

**5.14 Weightage**

The below table shows that the weight of the attributes take for the sample work. Weight of the attribute can be calculated using the equations (9) and equation (10). Using the above equation, weight calculated.

WEIGHT	$\mu(x)$	$V(x)$
W(Q1)	0.035	0.823
W(Q2)	0.044	0.833
W(Q3)	0.062	0.824
W(Q4)	0.072	0.827
W(Q5)	0.086	0.828
W(Q6)	0.089	0.812
W(Q7)	0.086	0.818
W(Q8)	0.080	0.813
w(Q9)	0.160	0.791
w(Q10)	0.300	0.780
W(Q11)	0.507	0.764

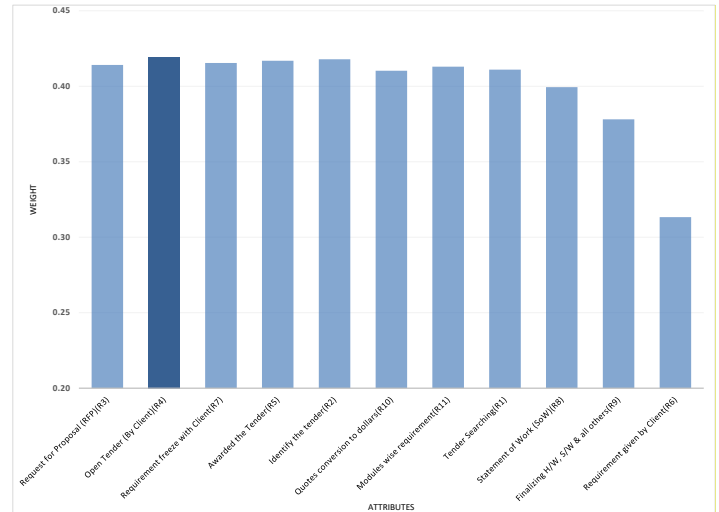
**Table 2** Weightage of the attributes

**5.15 Ranking**

The ranking can be found using the value of the weight of the respective attributes name. The highest weight of the attribute will be considered as the top ranking. The lowest weigh of the attribute will be considered as the last rank of attribute among the all the attribute. From the sample work Request for proposal (RFP) is the top rank of the attribute among the all attributes. Then the Equation 7 calculates, the distance between intuitionistic relation is calculated as  $d(\bar{I}, I)d(, I) = 0.09578$  which is less than  $\tau$ . Here the value of  $\tau$  will fix the cross over value as  $\tau = 0.15$ . Therefore the above matrix is consistent. From the equation 11, the preference for the attribute weightage calculated and arranged in descending order, it will give preference of the software requirement analysis.

S. No.	ATTRIBUTE NAME	WEIGHT	RANKING
1	Open Tender (By Client)(R4)	0.419	1
2	Identify the tender(R2)	0.418	2
3	Awarded the Tender(R5)	0.417	3
4	Requirement freeze with Client(R7)	0.415	4
5	Request for Proposal (RFP)(R3)	0.414	5
6	Modules wise requirement(R11)	0.413	6
7	Tender Searching(R1)	0.411	7
8	Quotes conversion to dollars(R10)	0.410	8
9	Statement of Work (SoW)(R8)	0.399	9
10	Finalizing H/W, S/W & all others(R9)	0.378	10
11	Requirement given by Client(R6)	0.313	11

**Table 3** .Ranking representation of all attributes



**Figure 4.** Graphical representation of the Weightage and Ranking of the Attributes.

The above figure 2 shows that, the graphical representation of the weightage and ranking of the all attributes of this work. The top level or the top hierarchy of these attribute "Open Tender (By Client)(R4)", the weight of this attribute is 0.419. The least ranking and the smallest weightage of the attribute is "Requirement given by Client (R6)", the weight of this attribute is 0.313.

**6. EMPIRICAL RESULT**

Identifying the significant attribute among the more number of attributes for deciding the priority is very difficult in the current scenario. In this proposed system identified the higher hierarchy attribute form the huge attributes for the software requirement analysis in software development process. Intuitionistic analytic hierarchy process is used to find the top level of hierarchy from the group of hierarchy. After analysis from the eleven attribute of software requirement analysis, Open Tender (By Client) (R4) is the higher important than others. Because, the weightage of the R4 is higher than the other attributes. So, the top rank given to the attribute Request for proposal.

**7. CONCLUSION**

Past few decades, entire global depends on the software's directly or indirectly for moving their day to day life. Software development process also getting the changes very frequently based on the need of compete or meet the client requirements. Satisfying the current clients or retaining the client and getting new client is for difficult for the each and every companies. Changes in the software development process is the important for them. In this work, ranking the attributes available in the software requirement analysis phase. Based on the suggestion given by the software industry experts software development process hierarchy framed. From the software development process. Software requirement analysis chosen for find the top ranking attribute among the eleven attribute. To find the top ranking, we have used the methodology of intuitionistic analytical hierarchy process with the support of the intelligent agent for the questionnaire process and allocation of questionnaire to the industry experts. Based on the industry expert's survey received through the leading web portal, the top rank of the attributes identified. "Open Tender (By Client)(R4)" is the top rank among the all



other attributes. This may helpful to the software industry to concentrate more on the top ranking attribute among their existing attributes for their development process for retain the client or to satisfy client requirements. It will be helpful to improve the business.

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