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Job Scheduling Algorithms and Type of Application in Grid Computing

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Abstract

Planning for Grid Computing has been dynamic territory of research since its start. In any case, novices find hard to comprehend related ideas because of an enormous expectation to learn and adapt of Grid figuring. Accordingly, there is a need of succinct comprehension of planning in Grid registering region. This paper endeavors to display brief comprehension of planning and related comprehension of Grid processing framework. The paper portrays by and large picture of Grid Computing and talks about significant subsystems that empower Grid processing conceivable. Additionally, the paper likewise examines ideas of asset booking and application planning and furthermore exhibits arrangement of planning calculations. Besides, the paper likewise displays procedure utilized for assessing booking calculations including both genuine framework and reproduction based methodologies. The displayed work on booking in Grid containing succinct understandings of planning framework, booking calculation, and booking approach would be exceptionally helpful to clients and scientists.

Keywords: *Clients, Grid, Job Scheduling, Grid Framework, Clients*

1. INTRODUCTION

Lattice registering has turned out to be obvious as the cutting edge parallel and conveyed processing procedure. A computational grid is defined as hardware and software infrastructure that provides dependable, consistent, pervasive, and inexpensive access to high-end computational capabilities Presently a days, framework registering has been broadly acknowledged, study, and offered thoughtfulness regarding by specialists [1]. Not at all like the conventional document trade, as upheld by the Web or distributed frameworks, can clients in the lattice get to the required asset or administration in a straightforward manner as though they were to utilize nearby assets or administrations. Be that as it may, it offers ascend to any of at least two thoughts strife between lattice clients and asset suppliers in use strategy of the nearby assets. For clients, notwithstanding straightforwardness and ease, to get alluring administration functionalities, some nature of administration (QoS) targets related with the administration, for example, lattice administration unwavering quality [2], the monetary expense of the asset, and the proficiency of framework administration, might be indicated

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when an administration is submitted. Then again, asset suppliers get the pay from matrix clients for the expended assets at the cost of yielding nearby undertaking executions [3].

1.1 TYPES OF GRIDS

A matrix can be characterized into three classifications: Computational lattice, Data framework and Service network. Fig. 1 demonstrates the classifications of network frameworks. A computational matrix gives access to enormous pool of shared preparing power appropriate for high throughput applications and calculation serious figuring. Contingent upon how the limit is used, computational lattice is grouped into Distributed Supercomputing matrix and High Throughput framework.

A supercomputing lattice executes applications on various machines in parallel to lessen the calculation time of an errand. An information framework gives a foundation to combining data from information chronicles, for example, advanced libraries or information stockrooms that are appropriated in a wide territory of system. European information lattice task and Globus are information framework activities, chipping away at growing huge scale information associations. An administration lattice gives benefits that can't be practiced by any single machine. The administration network additionally arranged into on-request matrix, communitarian framework and sight and sound lattice

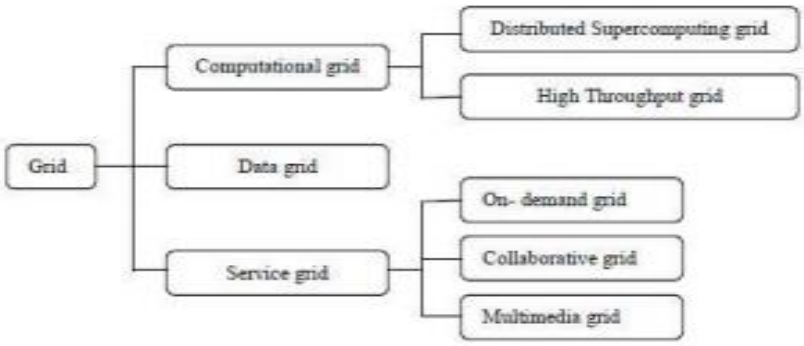

Figure 1. Types of Grids

1.2. CHARACTERISTICS OF COMPUTATIONAL GRID

There are many desirable properties and features that are required by a grid to provide users with a computing environment. They are as follows:

- **Heterogeneity:-**The grid involves a number of resources that are varied in nature and can encompass a large geographical distance through various domains.

- **Scalability:-**The grid should be tolerant to handle a large number of nodes without any performance degradation.

• **Adaptability** or Fault Tolerant :-In a grid unexpected computational aborts, hardware or software faults etc are high. These faults are generally handled by Resource Managers.

• **Security:-**All the user participating computers should be protected from any malicious manipulations or interventions.

2. LITERATURE REVIEW

The work that is reviewed in this document will be categorized by the component of the Smart Grid that it focuses on. It is possible that a work may fit into one or more of the possible categories, but it will be listed under the most prominent category. The Smart Grid is a large and complex system. Because of this complexity, research work typically only focuses on a single component. The different categories are listed below along with a detailed discussion of each.

2.1 HEURISTIC MIN-MEAN JOB SCHEDULING

Online mode and cluster mode are the two arrangements of heuristic booking calculations [9]. In online mode, the employments are planned to the assets when it arrives. In clump mode, the occupations are free, there is no structure of execution and employments are booked as a group without fail. Here in this paper, bunch mode booking is pursued. Accomplishing the base make span is the objective. To assess the mapping heuristic, the normal time to finish [ETC] model is utilized. Prior to execution, the normal execution time of the assignments on the machine ought to be known, and this is contained in the ETC grid. Consider for the assignment ti and the subjective machine mj ETC [ti, mj]. This speaks to the normal time of the undertaking I on the machine j.

In this lattice, the line speaks to the normal execution time of an assignment on various machine and segment speaks to the normal execution time of various undertakings on the equivalent machine[11][12][13]. In light of 3 qualities, the benchmark of examples for dispersed heterogeneous registering framework is created.

(i) Machine heterogeneity (low/high)

(ii) Task heterogeneity (low/high)

(iii) Consistency (Consistent/ Inconsistent/ Partially Consistent) Combining these 3 seat imprints, 12 blends of ETC grids are utilized to assess the heuristic minmean booking calculation. There are 2 stages in this calculation [14]. In the principal stage, all employments are doled out to the assets. In the second stage, mean fruition time of all employments is determined and the occupations are allotted to the machines whose finish time is not exactly the mean fulfilment time. Machine who has greatest culmination time is chosen as make span.

2.2 FIREFLY ALGORITHM

The firefly calculation depends on swarm insight conduct of firefly. It is a Meta heuristic calculation motivated by the social conduct of firefly. Firefly calculation finds the worldwide

ideal arrangement. The primary focal point of firefly calculation is to finished the assignment inside a base makespan and stream time too to use the network asset productively. Firefly enhancement as referenced in [15] [16] in can be portrayed as

(i) The firefly pulls in and is pulled in by every single other firefly.

(ii) The more brilliant one draws in the less more brilliant one.

(iii) The splendor diminishes with separation.

(iv) The most splendid firefly can move haphazardly.

(v) The firefly particles can move arbitrarily.

There are 4 stages in firefly calculation [17] In the stage 1, the parameters are set (introductory populace, wellness and engaging quality), number of accessible assets and rundown of submitted employments are recognized. In the stage 2, the splendor of every firefly is found at the source utilizing wellness capacity and separation is determined. The less brilliant fireflies are moved towards the more brilliant one. In the stage 3, the new arrangement is assessed and light power is refreshed in the stage 4, the fireflies are positioned and current worldwide best is distinguished. At long last, the emphasis parameters are refreshed All these are done until the end condition is come to. The end condition might be number of emphasis or the wellness esteem or now and then the immersion state.

3. PROPOSED WORK

Planning Terminology • Release-time (date): The most punctual time at which a vocation can begin its preparing. • Processing-time: The time-term required by an occupation to complete its preparing. • Start-time: The genuine time at which work begins its handling. • Finish-time: The real time at which an occupation completes its handling. • Expected execution time: It is a period expected to be taken up by a vocation to complete its execution. It is inferred exactly.

3.1 SCHEDULING IN SYSTEMS

Scheduling in Operating System is compared with Scheduling in Grid. In Operating System, most applications are client intelligent. Operating system does guidance level (CPU) booking. It adventures interleaving of I/O activities and CPU tasks. The principle goal of planning in OS is reasonableness among procedures. In Grid condition, most applications are not client intelligent. Network planning works at undertaking level in which parallelism of free assignments is misused. The principle objective in Grid planning is completion occupation or application at soonest. The booking of OS is of sort neighborhood planning as it decides how the procedures occupant on a solitary CPU are allotted and executed. The booking in Grid is of sort worldwide planning as it designates procedures to different assets to advance framework wide execution goal or application explicit target.

Relating Scheduling in Grid with Multiprocessor Scheduling: There exists a α, β, γ grouping plan [15] for order of planning issue. The α, β, γ arrangement plan of booking issues was initially displayed by Graham et al. also, later was stretched out by Veltman et al. Despite the fact that it is for multiprocessor condition, it can likewise be utilized for speaking to issue of planning on appropriated condition and the order plan has been utilized by numerous analysts in their work.

Relating Machine Scheduling with Grid Scheduling: The machine planning issue is referenced here to make per user acquainted with how Grid booking and machine planning [2] is connected. The epic methodologies utilized for machine planning issue can be investigated for their appropriateness in Grid booking. In machine booking issue, there are m machines, n occupations, and m errands (activity in each activity) per work. Three shop planning issues are compactly exhibited beneath.

- **Open-shop booking:** Different assignments of a similar activity might be planned for any request. On the off chance that appropriation of errands is permitted, the assignments can be interleaved.
- **Flow-shop booking:** If the request of undertakings is fixed and it is same for all occupations, at that point planning is called stream shop planning.
- **Job-shop booking:** In this planning, assignments of an occupation are completely requested, but the request of errands is potentially extraordinary for each activity.

In light of above meaning of various machine planning issues, the issue of booking of autonomous assignments in Grid can be identified with the Open shop planning and the issue of planning of ward errands in Grid can be identified with the Job-shop booking. Booking of circling some portion of the control stream diagram can be identified with Flow-shop planning.

3.2 GRID SYSTEM

1) Grid Middleware Grid middleware is a product that pastes assorted neighborhood assets of different associations to shape a larger amount, greater, worldwide asset. Framework middleware offers following administrations: (1) remote procedure/work the board to submit and to screen, (2) distribution and co-allotment of assets, (3) access to capacity gadgets and information the board, (4) data administration (sort of yellow page administration) including asset revelation, asset enlistment, and asset data update, and (5) security administration including validation, approval, appointment, and single sign on. Case of Grid middleware is as per the following: Globus [8], Legion [9], and Unicore [7]. Globus is accepted standard programming for structure Grid processing and it has been generally utilized in numerous Grid arrangements.

2) Batch Queue Controlled Resources In most Grid arrangements, singular assets of a

solitary association are halfway overseen utilizing clump line situated nearby asset the executives framework (LRM). In such framework, client submitted cluster employments are brought into the line of LRM, from which asset scheduler chooses about execution of occupations, A. Instances of such LRMs incorporate PBS [18], LSF [19]. An asset scheduler is otherwise called low-level scheduler or nearby scheduler. For process assets, LRM can be arranged for (I) which client is permitted to run occupations (ii) what strategies are related with choice of employments for running, and (iii) what approaches are related with individual machines for believing them to be inert. A LRM oversees two sorts of employments: nearby occupations produced inside an asset space and employments created by outside clients, for example Framework clients, see Figure 1. The basic motivation behind any LRM is to oversee, control, and calendar bunch forms on the assets under its control. Since, LRM manages dispersed assets; it is likewise called Distributed Resource Manager. Fundamental highlights of any LRM incorporate after: (1) scripting language for characterizing clump work, (2) interfaces for accommodation of cluster occupations, (3) interfaces to screen the executions, (4) interfaces to submit info and assemble yield information, (5) component for characterizing needs for employments, (6) coordinate creation of occupations with assets, and (7) booking occupations present in queue(s) to decide execution request of employments dependent on employment need, asset status, and asset distribution arrangement. Booking ahead of time based LRMs are likewise utilized in Grid. Instances of such LRMs incorporate Platform LSF, PBS Pro/Torque, Maui, and SGE.

Asset Monitoring Infrastructure Resource observing serves to Grid scheduler in taking suitable choice on accessible assets. Numerous asset checking systems are accessible. We talk about two generally utilized asset observing frameworks: one gives data on individual assets and another gives data on association between assets. System Weather Service (NWS) and Ganglia are most generally utilized system execution and asset observing frameworks in genuine Grid or group proving grounds.

Free Tasks Scheduling Systems Scheduling of use, regardless of whether autonomous assignments or ward an undertaking, in Grid registering includes following advances: asset disclosure, asset determination, plan age, and application execution. In the event of dynamic planning, the procedure may include extra advance of rescheduling or timetable adjustment.

4.MATERIALS AND METHODSUSED IN GRID ENVIRONMENT

I. ASSET SCHEDULING

Two sorts of planning: time sharing and space sharing are included at nearby asset level. Time sharing planning is utilized by each machine

(PC) of the bunch, for instance, CPU scheduler of the Operating System on each machine that is a piece of group framework, while space sharing booking is utilized by Local Resource Manager to plan the activity present in clump line on inert machine of the group. Asset booking is utilized to build use of assets or equalization load on the assets. For the most part a Grid site contains a group line controlled bunch, see Figure 1. Asset booking isn't entangled as it considers each submitted errand a free unit and accordingly the scheduler can blend in with or request with undertakings of different applications, either submitted from a similar Grid site or from other Grid locales. The asset booking includes taking two choices: work choice from a line/pack of employments and hub determination for chose work from accessible hubs. Figure 2 gives grouping of calculations under the two fundamental choice activities, which execute as a component of asset planning.

II. OCCUPATION SELECTION ALGORITHMS

Job determination calculation chooses work from a line of employments. The least complex sort of occupation determination calculations is Dispatching Rules based. FCFS calendars employments according to accommodation request (time). Briefest Processing Time First or Short-Job-First (SJF) allots most noteworthy need to the activity that has most brief preparing time. Longest Processing Time First or Largest-Size-First (LSF) doles out most elevated need to the activity that has longest handling time. Soonest Deadline First (EDF) doles out most elevated need to the procedure that has expected execution time in the most not so distant future or the predefined due date is in the most not so distant future. In unique dispatching guidelines based planning, choice changes relying on section of time. Least slack based calculation is of sort dynamic dispatching guidelines based booking. In this calculations, occupations are requested by their staying slack, which is characterized as slack = max (dj - pj - t, 0), where dj is due date, pj is preparing time, and t is the present time. Inlaying is an improvement of FCFS calculation. On the off chance that the most seasoned activity in the line can't be executed due to non-accessibility of enough/required assets, the more established employments are begun without postponing the most established lined occupation however the more seasoned activity arrived last than most established employment. Condor, LSF [19], and PBS [18] underpins inlaying based asset booking calculation. In Advance Reservation based Algorithm; client of asset sends reservation-demand for utilizing asset in future time. This early booking based calculation can ensure that required asset will be accessible to client for use; besides, employments don't have to hold up in line. Instances of frameworks supporting booking ahead of time based calculations are as per the following:

Platform LSF, PBS Pro/Torque, Maui, and SGE. Appropriation based asset planning calculation can stop execution of low need work when high need occupation arrives.

III. HUB ALLOCATION ALGORITHMS

Best Fit chooses the hub that has the least accessible assets and still can complete the activity. First Fit timetables the activity on the main reasonable asset in the rundown of accessible assets. Quickest Resource First chooses quickest accessible asset in the rundown of accessible assets. Min Loaded First chooses the asset having greatest unused CPU power or CPU use.

IV. APPLICATION SCHEDULING ALGORITHMS

Grid scheduler, to which clients present their applications, performs application booking, in which the scheduler takes planning choice about errands of entire application. Different terms are utilized for the term Grid scheduler. These terms incorporate super scheduler, meta-scheduler, worldwide scheduler, application intermediary, and application scheduler. Significant distinction between asset booking and application planning is that application level scheduler relegates a Grid site to a vocation while asset scheduler dispenses a machine of a group to a vocation. In view of time at which planning choice is taken, booking can be ordered into two: Static planning and dynamic planning. Static planning: It decides calendar of the considerable number of assignments of use before application begins to run. Static booking is material to both free undertakings and ward assignments applications. It is pertinent when the earth is thought to be static or no changing and when it is conceivable to appraise the execution times of errands (occupations).

V. DYNAMIC BOOKING

It decides calendar of an errand of an application just when the undertaking winds up prepared for execution. For booking of free errands application, all assignments can be planned in the meantime and in any request; be that as it may, for booking of ward undertakings application, an errand winds up prepared just when all its antecedent assignments have finished their execution. Dynamic planning is utilized when the earth is dynamic/evolving. It is utilized when it is difficult to decide the execution time or when errands (occupations) are coming on the web (constant). Precise calculation dependably delivers an ideal arrangement if exists. Heuristic creates an achievable and about ideal, yet not really ideal arrangement. The significant contrast among heuristic and metaheuristic is referenced beneath.

Heuristics: This methodology builds up a booking calculation that fits a specific sort of issue. Instances of heuristics incorporate after: Myopic, Batch planning, List booking, Clustering/gathering based planning, and Duplication based booking.

Meta-heuristics: This methodology builds up a general methodology of building up a

particular heuristic to fit a specific sort of issue, for instance, Genetic Algorithm, Simulated Annealing, Tabu Search, and Particle Swarm Optimization. In view of attributes of utilization, planning can be sorted into autonomous errands booking and ward assignments/work process planning. Free undertakings planning: In autonomous errands application, all assignments of uses are free of one another as far as any conditions. Accordingly they can be planned for any request by scheduler. Instances of autonomous undertakings booking calculations incorporate MET (Minimum Execution Time), MCT (Minimum Completion Time), Min-min, Max-min, and Suffrage.

5 .RESULT AND DISCUSSION

Planning for Grid is included at two dimensions: singular site level (asset booking) and application intermediary level (application booking) for which this paper gave grouping of different asset booking calculations and application booking calculations. The paper additionally talked about system to be utilized for assessing booking calculations. In particular, the paper featured reproduction based methodology and genuine framework based methodology and furthermore examined about when to utilize which one. The work likewise given significant execution measurements to assessing both asset booking and application planning. In Grid registering, execution assessment utilizing genuine framework takes a great deal of time, endeavours and requires master aptitudes though execution assessment.

CONCLUSION

This paper attempted to tie dialog on different constituent programming sub-frameworks of Grid processing dependent on booking viewpoint. This paper examined ideas of booking in Grid registering, an unpredictable framework, required at the most reduced dimension, some portion of working framework, to group framework and Grid computing framework. This paper likewise talks about significance of errand planning for disseminated condition, which is NP-Complete issue. Definite inquiry based calculations are not achievable and in this manner scientists need to search for heuristic based calculation.

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Effective Organisational Management and Employee Retention through Career Development

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Abstract

Human resource development is an integral part of Human resource function of an organization that deals with development of the human resource. In Current scenario of human resource development aiming to attain best level of HR practices there is more demand for Development of the employee career. Development of people is closely associated with development of organization. Employee's career plans and their developmental needs must be consciously linked with the organization's workforce needs as well its strategic direction. "Employee career development is a necessary strategy which will be maximizing individuals' career potential that in turn enhance the success of the organization as a whole". Organizations that fail to allow employees to meet their individual developmental needs will be losing valued employees. This paper will focus on the role and importance of Career Development Programs in developing and retaining employees.

Key words: *Career development, Employee retention*

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1. INTRODUCTION

Career Development is the lifelong process of managing learning, work, leisure, and transitions in order to move toward a personally determined and evolving preferred future. Organizations need to realize that healthy career development for their human force is a way of attracting and retaining the best people. Effective career support by employers to their employees in the workplace meets both business and individual needs. It will be a mutual benefit only if both parties realize their roles.

The performance of all employees matters to the company and organizational motivation matters to employees. Organizations must aim to create a learning environment that encourages employees to develop new capabilities that build long-term careers and Provide best developmental opportunities for their potential. Understanding how to motivate employees, and acknowledging workers performance, is likely to be a critical factor for organizational success. Paying attention to the career development of individuals will be vital not only for skill development but also to help motivate superior performance at work by giving people a clearer sense of direction and purpose.

Career development means developing the ability, attain management skill to manage greater authority, more

decision making knowledge, the development to supervise or teach other employees or work independently. It also usually leads to more compensation or perks. This is also known as career advancement. Thus career development will allow employees to fulfil their career needs, and organizations will benefit by retaining a greater number of their competent and qualified employees.

2. LITERATURE REVIEW

A study (winter and Jackson, 2004) asked over 700 high-performing employees in a small sample of large (mostly global) organizations to comment on the conversations they had at work which had impact on them. It found that they were not always getting the types of conversations they most needed. About half of the conversations having the greatest impact were performance-related, and about half of these took place in appraisals. By contrast, only about a quarter of high-impact conversations were development-related, and less than a quarter of these took place in appraisals. The lack of development conversations was a major source of dissatisfaction.

In today's competitive environment, it is imperative that all organizations create a work environment which fosters growth and development. It is apparent this can be accomplished by implementing a Career Development Program in the workplace. This will enhance organizational loyalty among employees, result in higher levels of job satisfaction, lower employee turnover, and fewer employee complaints (Werther & Davis, 1992).

In a 1978 survey conducted by the American Management Association on company-sponsored Career Development Programs, over 90% of the respondents found them to enhance job performance, help employees use personnel systems more effectively, and improve the utilization of available talent (Walker & Gutteridge, 1979).

3. RESEARCH METHODOLOGY

Objectives of the study: To measure the perception of employees towards their job career development

To find out whether the personal profile of the respondents influencing their perception on career development.

Study strategy: Descriptive research is being used. The purpose behind this type of research is to study frequencies, averages, and other statistical calculations. This research is highly accurate, although the research does not investigate the causes behind a situation. Descriptive research is mainly done when a researcher wants to gain a better understanding of study adopted.Hypothesis:

- Relationship between the experience of the respondents and their perception on career advancement
- Relationship between the monthly income of the respondents and their job satisfaction obtained.

Universe: Researcher conducted the study among employees the population were 200 Employees. Among them the researcher selected 60 Employees as (30 %) sample for the study.

Sampling design: Sample is a portion of the people drawn from a larger portion. It is a finite subset of the population. Out of the total population, 60 samples were taken for the study.

Sampling procedure: Sampling refers to the selection of optimum number of persons from a definite population. Sampling design refers to a definite plan for obtaining a sample from a given population.

The sampling technique adopted for the study is simple random sampling (Lottery Method).

Tools of Data collection: The major tool used by the researcher for collecting data is questionnaire from the employees of hotel 'THE RESIDENCY', Coimbatore.

4. ANALYSIS AND INTERPRETATION

1. Cross tabulation between the years of experience of the respondents and their perception on career advancement

Level of significance a= 0.050

Chi Square (x^2) = $(O-E)^2 / E$

O =Observed frequency

E= Expected frequency

CHI – SQUARE TABLE:

	Value	**df**	**Asmp. Sig. (2-sided)**
Pearson Chi-Square	8.948[a]	3	.030

Experience	My job has career advancement				
	D	N	A	SA	Total
Below 5 yrs.	10	17	11	7	45
	22.2%	37.8%	24.4%	15.6%	100.0%
5-10yrs	1	3	10	1	15
	6.7%	20.0%	66.7%	6.7%	100.0%
Total	11	20	21	8	60
	18.3%	33.3%	35.0%	13.3%	100.0%

The calculated value of chi-square (x2) = 8.948

The degree of freedom = 3

Table value = 7.815

Interpretation: The calculated value of chi-square (8.948) is greater than the table value (7.815) at 0.050 levels of significance; thus experience and their perception on career advancement are associated.

2. Cross tabulation between the monthly income of the respondents and their job satisfaction obtained

Monthly income	I am satisfied with my job				
	D	N	A	SA	Total
Rs.5000-Rs.10000	6	4	16	14	40
	15.0%	10.0%	40.0%	35.0%	100.0%
Rs.10000- Rs.15000	2	3	6	9	20
	10.0%	15.0%	30.0%	45.0%	100.0%
Total	8	7	22	23	60
	13.3%	11.7%	36.7%	38.3%	100.0%

Level of significance a= 0.050

Chi Square (x2) = $(O-E)^2 / E$

O=Observed frequency

E= Expected frequency

CHI – SQUARE TABLE:

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.247a	3	.742

The calculated value of chi-square (x2) = 1.247

The degree of freedom = 3

Table value = 7.815

Interpretation: The calculated value of chi-square (1.247) is less than the table value (7.815) at 0.050 levels of significance. Therefore the two attributes, the monthly income and the satisfaction obtained from work are not associated.

5. MAJOR FINDINGS

There is a significant relationship between the years of experience and their perceptions on career advancement are associated. There is no relationship between the monthly income and the satisfaction obtained from work is not associated.

6. DISCUSSION

Since Experience gained in organization has influence on perception towards career advancement, we find that more of experience leads to understanding the organization by employee and employee who is satisfied with career advancement will stay for a long period thus the researcher suggest that career advancement is a major retention strategy. Retention strategy has to be adopted to increase the population of experienced employees which can make way for more satisfied employees. It is found from study that income is not a prime factor which influences satisfaction of the employee in an organization. Thus an institution has never satisfied its work force by giving monetary remuneration alone. It has adopted career development concept as employee development which will lead to organizational development as whole.

7.CONCLUSION

A good human resources practice would encourage all employees to be more productive while enjoying work. There is a lot more power and capacity for individual to equip himself for organizational transformation when development is available for most or all employees, not just the salary hike. Thus career development is not only of "going high", but rather about utilizing the human potential to bring the best performance and attaing a place in an organization where they can contribute their excellence and reach the goals of the organization.

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An Application of Intuitionistic Fuzzy Soft Sets in Drug Addiction using Intuitionistic Fuzzy Soft Complement

A.Nithya

Abstract

In this paper we introduce a matrix representation of Intuitionistic fuzzy soft set and extend Sanchez's approach for medical diagnosis using our notion of Intuitionistic fuzzy soft complement.

1. INTRODUCTION

In the fuzzy set theory initiated by Zadeh [13] in 1965, it has been accepted that the classical set theoretic axioms of exclusion and contradiction are not satisfied. In this regard, H.K.Baruah [2,3] proposed that two functions, namely fuzzy membership function and fuzzy reference function are necessary to represent a fuzzy set. Accordingly, Baruah [2,3] reintroduced the notion of complement of a fuzzy set in a different way and proved that indeed the set theoretic axioms of exclusion and contradiction are valid for fuzzy set also.

In 1999, Molodstov [8] introduced the theory of soft sets, which is a new mathematical approach to vagueness. In recent years the researchers have contributed a lot towards fuzzification of soft set theory. Maji et al. [6] initiated the concept of fuzzy soft set with some properties regarding fuzzy soft union and intersection, complement of a fuzzy soft set, De Morgan's Law etc. These results were further revised and improved by Ahmad and kharal. They defined arbitrary fuzzy soft union and intersection and proved De Morgan's Inclusions and De Morgan's Laws in fuzzy soft set theory. In 2011, Neog and Sut [9] have reintroduced the notion of fuzzy soft sets and redefined the complement of a fuzzy soft set accordingly. They have shown that the modified definition of complement of a fuzzy soft set meets all the requirements that complement of a set in classical sense really does.

Now a days, applications of fuzzy soft set theory in many disciplines and real life situations have been studied by many researchers. De et.al [5] have studied Sanchez's [11,12] method of medical diagnosis using intuitionistic fuzzy set. Saikia et.al. [10] have extended the method in [5] using intuitionistic fuzzy soft set theory. In [4] Chetia and Das have studied Sanchez's approach of medical diagnosis through IVFSS obtaining an improvement of the same presented in De et.al. [5]. Using the representation of interval valued fuzzy matrix, Meenakshi et.al. [7] have provided the techniques to study Sanchez's approach of medical diagnosis of interval valued fuzzy matrices. They have compared their technique with the one found in [4], for the same hypothetical case study presented an interval valued fuzzy matrix A and directly applied sanchez's method of

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medical diagnosis for the (A), which is a fuzzy matrix. In this paper, by using the definition of complement of a fuzzy soft set proposed by Neog and Sut [9] and the notion of fuzzy sets reintroduced by H.K.Baruah [2,3] the author put a forward a matrix representation of fuzzy soft set and extend Sanchez's approach for medical diagnosis. We have considered the hypothetical case study taken by Chetia et.al. [4] and later by Meenakshi et.al. [7] and arrived at the same conclusion in our way as was obtained in [4] and [7].

2. PRELIMINARIES

- **Definition 2.1:** A pair (F,E) is called a soft set (over U) if and only if F is a mapping E into the set of all subsets of the set U. In other words, the soft set is a parameterized family of subsets of the set U. Every set $F(\varepsilon), \varepsilon \in E$, from this family may be considered as the set of ε -elements of the set (F,E), are as the set of ε-approximate elements of the soft set.
- **Definition 2.2:** An intuitionisitc fuzzy set A over the universe U can be defined as follows- $A=\{(x,\mu_A(x),\gamma_A(x)): x\in U\}$, where $\mu_A(x): U\to[0,1], \gamma_A(x): U\to[0,1]$ with the property $0\le\mu_A(x)+\gamma_A(x)\le 1\ \forall x\in U$. The values $\mu_A(x)$ and $\gamma_A(x)$ represent the degree of membership and non-membership of x to A respectively.

$\pi_A(x)=1-(\mu_A(x)+\gamma_A(x))$ is called the intuitionisitic fuzzy index.

- **Definition 2.3:** Let U be an initial universe set and E be the set of parameters. Let IF^U denote the collection of all intuiitonistic fuzzy subsets of U. Let $A\subseteq E$. A pair (F,A) is called an intuitionistic fuzzy soft set over U where F is a mapping given by $F: A\to IF^U$.
- **Definition 2.4:** A soft set (F,A) over U is said to be null intuitionistic fuzzy soft set denoted by ϕ if $\forall\varepsilon\in A, F(\varepsilon)$ id the null intuitionistic fuzzy set $\bar{0}$ of U where $\bar{0}(x)=0\forall x\in U$. We would use the notation (F,ϕ) to represent the intuitionistic fuzzy soft null set with respect to the set of parameters A.
- **Definition 2.5:** A soft set (F,A) over U is said to be absolute intuitionistic fuzzy soft set denoted by $\tilde{A}$ if $\forall\varepsilon\in A, F(\varepsilon)$ id the absolute intuitionistic fuzzy set $\bar{1}$ of U where $\bar{1}(x)=1\forall x\in U$. We would use the notation (U,A) to represent the intuitionistic fuzzy soft null set with respect to the set of parameters A.
- **Definition 2.6:** For two intuitionistic fuzzy soft sets (F,A) and (G,B) over (U,E)we say that (F,A) is an intuitionistic fuzzy soft subset of (G,B), if

  (i) $A\subseteq B$

  (ii) For all, $\varepsilon\in A$, $F(\varepsilon)\subseteq G(\varepsilon)$ and is written as $(F,A)\subseteq(G,B)$.
- **Definition 2.7:** Union of two intuitionistic fuzzy soft sets (F,A) and (G,B) over (U,E) is an intuitionistic fuzzy soft set (H,C) where $C=A\cup B$ and $\forall\varepsilon\in C$,

$$H(\varepsilon)=\begin{cases}F(\varepsilon), & \text{if } \varepsilon\in A-B\\ G(\varepsilon), & \text{if } \varepsilon\in B-A\\ H(\varepsilon), & \text{if } \varepsilon\in A\cup B\end{cases}$$

and is written as $(F,A)\tilde{\cup}(G,B)=(H,C)$.

❖ **Definition 2.8:** Let (F,A) and (G,B) be two intuitionistic fuzzy soft sets over (U,E). Then intersection (U,E) and (G,B) is an intuitionistic fuzzy soft set (H,C) where $C=A\cap B$ and $\forall\varepsilon\in C$, $H(\varepsilon)=F(\varepsilon)\cap G(\varepsilon)$. We write $(F,A)\tilde{\cap}(G,B)=(H,C)$.

❖ **Definition 2.9:** Let (F,A) and (G,B) be two intuitionistic fuzzy soft sets in a soft class $(U,E)$with $A\cap B\neq\phi$. Then intersection of two fuzzy soft (F,A) and (G,B) in a soft class (U,E) is a fuzzy soft set (H,C) where $C=A\cap B$ and $\forall\varepsilon\in C$, $H(\varepsilon)=F(\varepsilon)\cap G(\varepsilon)$. We write $(F,A)\tilde{\cap}(G,B)=(H,C)$

❖ **Definition 2.10:** The complement of an intuitionistic fuzzy

soft set (F,A) is denoted by $(F,A)^c$ and is defined by $(F,A)^c=(F^c,A)$, where $F^c:A\to IF^U$ is a mapping given by $F^c(\varepsilon)=[F(\varepsilon)]^c$ for all $\varepsilon\in A$. Thus if

$F(\varepsilon)=\{x,\mu_{F(\varepsilon)}(x),\gamma_{F(\varepsilon)}(x):x\in U\}$,then $\forall\varepsilon\in A$

$F^c(\varepsilon)=[F(\varepsilon)]^c=\{x,\mu_{F(\varepsilon)}(x),\gamma_{F(\varepsilon)}(x):x\in U\}$

❖ **Definition 2.11:** If (F,A) and (G,B) be two intuitionistic fuzzy soft sets, then "(F,A) AND (G,B)" is an intuitionistic fuzzy soft set denoted by $(F,A)\wedge(G,B)$ and is defined by $(F,A)\wedge(G,B)=(H,A\times B)$,where $H(\alpha,\beta)=F(\alpha)\cap G(\beta)$, $\forall\alpha\in A$ and $\forall\beta\in B$, where $\cap$ is the operation intersection of two intuitionistic fuzzy sets.

❖ **Definition 2.12:** If (F,A) and (G,B) be two intuitionistic fuzzy soft sets, then "(F,A) OR (G,B)" is an intuitionistic fuzzy soft set denoted by $(F,A)\vee(G,B)$ and is defined by $(F,A)\vee(G,B)=(K,A\times B)$, where $K(\alpha,\beta)=F(\alpha)\cup G(\beta)$, $\forall\alpha\in A$ and $\forall\beta\in B$, where $\cup$ is the operation union of two intuitionistic fuzzy sets.

❖ **Definition 2.13:** The membership value matrix corresponding to the matrix A as $MV(A)=[\delta(A)_{ij}]_{m\times n}$, where

$\delta(A)_{ij}=\mu_A(c_i)-\nu_A(c_i)\ \forall i=1,2,3,.....m$; $j=1,2,3,.....n$,

where $\mu_A(c_i)$ and $\nu_A(c_i)$ represent the intuitionistic fuzzy membership function and intuitionistic fuzzy non-membership function respectively of c_i in the intuitionistic fuzzy set $F(e_j)$.

❖ **Definition 2.14:** Let $A=[a_{ij}]_{m\times n}$, $a_{ij}=(\mu_A(c_i),\nu_A(c_i))$; $\mu_A(c_i)$ and $\nu_A(c_i)$ represent the intuitionistic fuzzy membership function and intuitionistic fuzzy non-membership function respectively of c_i, so that $\delta_{ij}(c_i)=\mu_A(c_i)-\nu_A(c_i)$ gives the intuitionistic fuzzy membership value of c_i. Also let $B=[b_{ij}]_{n\times p}$, $a_{ij}=(\mu_B(c_i),\nu_B(c_i))$ where $\mu_B(c_i)$ and $\nu_B(c_i)$ represent the intuitionistic fuzzy membership function and intuitionistic fuzzy non-membership function respectively of c_i, so that $\delta_{ij}(c_i)=\mu_B(c_i)-\nu_B(c_i)$ gives the intuitionistic fuzzy membership value of c_i. We now define $A\cdot B$ the product of A and B as,

$$A\cdot B=[c_{ij}]_{m\times p}$$
$$=[\max\min(\mu_A(c_i),\mu_B(c_i)),\min\max(\nu_A(c_i),\nu_B(c_i))]_{m\times p}$$

3. MATRIX REPRESENTATION OF AN INTUITIONISTIC FUZZY SOFT SET

Let $U=\{c_1,c_2,c_3,.....,c_m\}$ be the universal set and E be the set of parameters given be $E=\{e_1,e_2,e_3,.....,e_n\}$. Then the intuitionistic fuzzy soft set (F,A) can be expressed in matrix form as $A=[a_{ij}]_{m\times n}$ or simply by $[a_{ij}]$, $i=1,2,3,.....m$; $j=1,2,3,.....n$ and $[a_{ij}]=(\mu_A(c_i),\nu_A(c_i))$ where $\mu_A(c_i)$ and $\nu_A(c_i)$ represent the intuitionistic fuzzy membership function and intuitionistic fuzzy non-membership function respectively of c_i in the intuitionistic fuzzy set $F(e_j)$ so that $\delta_{ij}(c_i)=\mu_a(c_i)-\nu_A(c_i)$ gives the intuitionistic fuzzy membership value of c_i. We shall identify a fuzzy soft set with s fuzzy soft matrix and use these two concepts interchangeable. The set of all $m\times n$ intuitionistic fuzzy soft matrices over U will be denoted by $IFSM_{m\times n}$.

Example 3.1

Let $U=\{c_1,c_2,c_3,c_4\}$ be the universal set and E be the set of parameters given by $E=\{e_1,e_2,e_3\}$. Let us consider a intuitionistic fuzzy soft set

$$(F,E)=\begin{Bmatrix}F(e_1)=\{(c_1,0.5,0.3),(c_2,0.4,0.2),(c_3,0.6,0.3),(c_4,0.7,0.1)\}\\F(e_2)=\{(c_1,0.6,0.2),(c_2,0.8,0.2),(c_3,0.9,0.1),(c_4,0.4,0.4)\}\\F(e_3)=\{(c_1,0.5,0.2),(c_2,0.6,0.4),(c_3,0.7,0.3),(c_4,0.8,0.1)\}\end{Bmatrix}$$

Let us represent the given intuitionistic fuzzy soft set in matrix form as

$$[a_{ij}]_{4\times 3}=\begin{bmatrix}(0.5,0.3) & (0.6,0.2) & (0.5,0.2)\\(0.4,0.2) & (0.8,0.2) & (0.6,0.4)\\(0.6,0.3) & (0.9,0.1) & (0.7,0.3)\\(0.7,0.1) & (0.4,0.4) & (0.8,0.1)\end{bmatrix}$$

4. INTUITIONISTIC FUZZY SOFT SETS IN MEDICAL DIAGNOSIS

Let us assume that S is the set of symptoms of some diseases, D is the set of diseases related to these symptoms and P is the set of patients showing the symptoms present in the set S. Here construct the intuitionistic fuzzy soft set (F,D) over S. A relation matrix R_1 is obtained from the intuitionistic fuzzy soft set (F,D). This matrix is called the symptom-disease matrix. Similarly its complement $(F,D)^c$ gives another relation matrix R_2, called non symptom diseases matrix. Analogous to Sanchez's notion of medical knowledge, we call the matrices R_1 and R_2 as medical knowledge of an intuitionistic fuzzy soft set. Again we construct another intuitionistic fuzzy soft set (F_1,S) over P. This intuitionistic fuzzy soft set gives the relation matrix Q_1 called patient symptom matrix and its complement $(F_1,S)^c$ gives the relation matrix Q_2, called patient non-symptom matrix. Then using the definition 2.14 above, we obtain two new relation matrices $T_1=Q_1\cdot R_1$ and $T_2=Q_1\cdot R_2$ called patient symptom disease matrix and patient symptom non disease matrix respectively. In similar way, we obtain the relation matrices $T_3=Q_2\cdot R_1$ and $T_4=Q_2\cdot R_2$ called patient non symptom disease matrix and patient non symptom non disease matrix respectively.

Now, $T_1=Q_1\cdot R_1, T_2=Q_1\cdot R_2, T_3=Q_2\cdot R_1, T_4=Q_2\cdot R_2$ (4.1)

By using the definition 2.13, we then obtain the corresponding membership values matrices $MV(T_1), MV(T_2), MV(T_3)$ and $MV(T_4)$. We calculate the

diagnosis score S_{T_1} and S_{T_2} for and against the disease respectively as

$S_{T_1} = [\gamma(T_1)_{ij}]_{m\times n}$, where $\gamma(T_1)_{ij} = \delta(T_1)_{ij} - \delta(T_3)_{ij}$

(4.2)

and $S_{T_2} = [\gamma(T_2)_{ij}]_{m\times n}$, where $\gamma(T_2)_{ij} = \delta(T_2)_{ij} - \delta(T_4)_{ij}$

(4.3)

Now if $\max_j (S_{T_1}(p_i, d_j) - S_{T_2}(p_i, d_j))$ occurs for exactly (p_i, d_k) only, then we would be in a position to accept that diagnostic hypothesis for patient p_i is the disease d_k. In case there is a tie, the process is repeated for patient p_i by reassessing the symptoms.

5. ALGORITHM

1. Input the Intuitionistic fuzzy soft set (F, D) and compute $(F, D)^c$. Compute the corresponding matrices R_1 and R_2.
2. Input the Intuitionistic fuzzy soft set (F_1, S) and compute $(F_1, S)^c$. Compute the corresponding matrices Q_1 and Q_2.
3. Compute $T_1 = Q_1 \cdot R_1$, $T_2 = Q_1 \cdot R_2$, $T_3 = Q_2 \cdot R_1$ and $T_4 = Q_2 \cdot R_2$
4. Compute the corresponding membership value matrices $MV(T_1), MV(T_2), MV(T_3)$ and $MV(T_4)$.
5. Compute the diagnosis scores S_{T_1} and S_{T_2}.
6. Find $S_k = \max_j (S_{T_1}(p_i, d_j) - S_{T_2}(p_i, d_j))$. We conclude that patient p_i is suffering from the disease d_k.
7. If S_k has more than one value, then go to step-1 and repeat the process by reassessing the symptoms for the patient.

6. CASE STUDY

Suppose that there are three patients P_1, P_2, P_3 are admitted in a hospital those who intake over dosage for sensual pleasure which will affect the brain cells lead to the symptoms of Hysteria, then the patient who used sleeping pills will have the side effect of headache and stomach pain, then the patient who take birth control pills will have the side effect of depression and stroke. We consider the set $S = \{e_1, e_2, e_3\}$ as universal set where e_1, e_2, e_3 represent the symptoms of hysteria, headache and stomach pain, depression and stroke problems respectively and the set $D = \{d_1, d_2\}$, where d_1, d_2 represent the parameters of side effect in the human body, particularly brain and heart problem diseases respectively.

Suppose that intuitionistic fuzzy soft set (F, D) over S, where F is a mapping $F : D \to \tilde{F}(S)$, gives an approximate description of intuitionistic fuzzy soft medical knowledge of the two diseases and their symptoms.

$$(F, D) = \begin{Bmatrix} F(d_1) = \{(e_1, 0.7, 0.3), (e_2, 0.6, 0.2), (e_3, 0.5, 0.4)\} \\ F(d_2) = \{(e_1, 0.4, 0.4), (e_2, 0.5, 0.4), (e_3, 0.6, 0.1)\} \end{Bmatrix}$$

Complement of (F, D) i.e. $(F, D)^c$ is given by

$$(F, D)^c = \begin{Bmatrix} F^c(d_1) = \{(e_1, 0.3, 0.7), (e_2, 0.2, 0.6), (e_3, 0.4, 0.5)\} \\ F^c(d_2) = \{(e_1, 0.4, 0.4), (e_2, 0.4, 0.5), (e_3, 0.1, 0.6)\} \end{Bmatrix}$$

We represent the intuitionistic fuzzy soft sets (F,D) and $(F,D)^c$ by the following matrices R_1 and R_2 respectively.

$$R_1 = \begin{array}{c} \\ e_1 \\ e_2 \\ e_3 \end{array}\begin{bmatrix} d_1 & d_2 \\ (0.7,0.3) & (0.4,0.4) \\ (0.6,0.2) & (0.5,0.4) \\ (0.5,0.4) & (0.6,0.1) \end{bmatrix} \text{ and } R_2 = \begin{array}{c} \\ e_1 \\ e_2 \\ e_3 \end{array}\begin{bmatrix} d_1 & d_2 \\ (0.3,0.7) & (0.4,0.4) \\ (0.2,0.6) & (0.4,0.5) \\ (0.5,0.4) & (0.1,0.6) \end{bmatrix}$$

Again we take $P = \{P_1, P_2, P_3\}$ as the universal set where P_1, P_2 and P_3 represent three patients respectively and $S = \{e_1, e_2, e_3\}$ as the set of parameters where e_1, e_2, e_3 represent the symptoms hysteria, headache and stomach pain, depression and stroke problems respectively.

Let (F_1, S) Intuitionistic fuzzy soft set, where F_1 is a mapping $F_1 : S \to \tilde{F}(P)$, gives a collection of an approximate description of the patient symptoms in the hospital. Let

$$(F_1,S) = \begin{Bmatrix} F_1(e_1) = \{(P_1,0.6,0.2),(P_2,0.5,0.4),(P_3,0.7,0.2)\} \\ F_1(e_2) = \{(P_1,0.4,0.3),(P_2,0.3,0.3),(P_3,0.9,0.1)\} \\ F_1(e_3) = \{(P_1,0.8,0.2),(P_2,0.6,0.4),(P_3,0.5,0.2)\} \end{Bmatrix}$$

We represent this Intuitionistic fuzzy soft set (F_1, S) by the following matrix Q_1, called patient-symptoms matrix.

$$Q_1 = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \end{array}\begin{bmatrix} e_1 & e_2 & e_3 \\ (0.6,0.2) & (0.4,0.3) & (0.8,0.2) \\ (0.5,0.4) & (0.3,0.3) & (0.6,0.4) \\ (0.7,0.2) & (0.9,0.1) & (0.5,0.2) \end{bmatrix}$$

Complement of (F_1, S) i.e. $(F_1, S)^c$ is given by

$$(F_1,S)^c = \begin{Bmatrix} F_1^c(e_1) = \{(P_1,0.2,0.6),(P_2,0.4,0.5),(P_3,0.2,0.7)\} \\ F_1^c(e_2) = \{(P_1,0.3,0.4),(P_2,0.3,0.3),(P_3,0.1,0.9)\} \\ F_1^c(e_3) = \{(P_1,0.2,0.8),(P_2,0.4,0.6),(P_3,0.2,0.5)\} \end{Bmatrix}$$

We represent this intuitionistic fuzzy soft set $(F_1, S)^c$ by the following matrix Q_2, called patient-non symptom matrix.

$$Q_2 = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \end{array}\begin{bmatrix} e_1 & e_2 & e_3 \\ (0.2,0.6) & (0.3,0.4) & (0.2,0.8) \\ (0.4,0.5) & (0.3,0.3) & (0.4,0.6) \\ (0.2,0.7) & (0.1,0.9) & (0.2,0.5) \end{bmatrix}$$

Thus we have

$$T_1 = Q_1 \cdot R_1 = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \end{array}\begin{bmatrix} d_1 & d_2 \\ (0.6,0.3) & (0.6,0.2) \\ (0.5,0.3) & (0.6,0.4) \\ (0.7,0.2) & (0.5,0.4) \end{bmatrix} \text{ and}$$

$$T_2 = Q_1 \cdot R_2 = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \end{array}\begin{bmatrix} d_1 & d_2 \\ (0.5,0.4) & (0.4,0.4) \\ (0.5,0.4) & (0.4,0.4) \\ (0.5,0.4) & (0.4,0.4) \end{bmatrix}$$

We have now the following membership value matrices $MV(T_1)$ and $MV(T_2)$.

$$MV(T_1) = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \end{array}\begin{bmatrix} d_1 & d_2 \\ 0.3 & 0.4 \\ 0.2 & 0.2 \\ 0.5 & 0.1 \end{bmatrix} \text{ and } MV(T_2) = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \end{array}\begin{bmatrix} d_1 & d_2 \\ 0.1 & 0 \\ 0.1 & 0 \\ 0.1 & 0 \end{bmatrix}$$

Again

$$T_3 = Q_2 \cdot R_1 = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \end{array}\begin{bmatrix} d_1 & d_2 \\ (0.3,0.4) & (0.3,0.4) \\ (0.4,0.3) & (0.4,0.4) \\ (0.2,0.5) & (0.2,0.5) \end{bmatrix} \text{ and}$$

$$T_4 = Q_2 \cdot R_2 = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \end{array}\begin{bmatrix} d_1 & d_2 \\ (0.2,0.6) & (0.3,0.5) \\ (0.4,0.6) & (0.4,0.5) \\ (0.2,0.7) & (0.2,0.6) \end{bmatrix}$$

We have now the following membership value matrices $MV(T_3)$ and $MV(T_4)$.

$$MV(T_3) = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \end{array} \begin{bmatrix} d_1 & d_2 \\ -0.1 & -0.1 \\ 0.1 & 0 \\ -0.3 & -0.3 \end{bmatrix} \text{ and } MV(T_4) = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \end{array} \begin{bmatrix} d_1 & d_2 \\ -0.4 & -0.2 \\ -0.2 & -0.1 \\ -0.5 & -0.4 \end{bmatrix}$$

Compute the diagnosis scores S_{T_1} and S_{T_2} for and against the disease as below

$$S_{T_1} = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \end{array} \begin{bmatrix} d_1 & d_2 \\ 0.4 & 0.5 \\ 0.1 & 0.2 \\ 0.8 & 0.4 \end{bmatrix} \text{ and } S_{T_2} = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \end{array} \begin{bmatrix} d_1 & d_2 \\ 0.5 & 0.2 \\ -0.1 & 0.1 \\ 0.6 & 0.4 \end{bmatrix}$$

.Now the difference for and against the diseases as

$S_{T_1} - S_{T_2}$	d_1	d_2
P_1	-0.1	0.3
P_2	0.2	0.1
P_3	0.2	0

We conclude that the patient P_1 is suffering from the disease d_2 and the patients P_2 and P_3 both are suffering from disease d_1.

CONCLUSION

In this work, we have considered the same hypothetical case study taken by Chetia et.al. [4] and later by Meenakshi et.al. [7] and applying Sanchez's approach, we have arrived at the same conclusion as was obtained in [4] and [7]. Our approach is more rational in the sense that we are using our new notion of Intuitionistic fuzzy soft complement initiated in [9] and the intuitionistic fuzzy sets in our work have been replaced with extended fuzzy sets initiated by Baruah in [2,3]. We have put forward a matrix representation of intuitionistic fuzzy soft set and the operation "product" for intuitionistic fuzzy matrices. Future work in this regard would be required to study whether the notions put forward in this paper yield a fruitful result.

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Share Price Movements of the Select Non-Banking Financial Company in Japan Candlestick Model

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Abstract

Investing is one of the most crucial decision that each person has to make at one point of the time. One of the best options available is the investment in shares and securities of the companies. India is receiving considerable capital inflows in recent years and it plays a major role in the growth of the economy. The factors such as inflation, interest rate, deflation and exchange rates influence the stock prices. A better understanding of the stock market trend will facilitate allocation of financial resources to the most profitable investment opportunities. The behaviour of stock returns will enable the investors to make appropriate investment decisions. This study analysis the share price movements of Bajaj Finance Ltd and Muthoot Finance Ltd . The main objectives of this study is to analyse the share price movements of selected stocks of non-banking financial companies namely Bajaj Finance Ltd. and Muthoot Finance Ltd.

This study will help the investors to identify the current trend and risks associated with the securities in the stock market. This study is purely based on the secondary data available in Bombay Stock Exchange (BSE) website. The analyse in Two years from April 2015 to March 2017. The analysis reveals that there is a possibility of getting benefits

by investing in the shares of the Bajaj Finance Ltd . The investors should understand the situations like market price, economy, company progress, returns and risk involved in the investments.

Keywords : Balai Finance ,Muthoot Finance , Stock Trends , Share Price Movement ,Bombay Stock Exchange

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1. INTRODUCTION

"An Investment in Knowledge pays the best Interest."- Benjamin Franklin. In financial markets, a share is a unit of account for various investments. It often means the stock of a corporation, but is also used for collective investments such as mutual funds, limited partnerships and real estate investment trusts. Corporation issue shares which are offered for sale to raise share capital. The owner of shares in the corporation is a shareholder of the corporation. A share is an indivisible unit of capital, expressing the ownership relationship between the company and the shareholder. The denominated value of a share is its face value and the total of the face value of issued shares represent the capital of a

company, which may not reflect the market value of those shares.

The income received from the ownership of shares is a dividend. There are different types of shares such as equity shares, preference shares, bonus shares, right Shares, employees' stock option plans and sweat equity shares.

2. SECURITIES AND EXCHANGE BOARD OF INDIA (SEBI)

The Securities and Exchange Board of India (SEBI) is the regulator for the securities market in India. It was established in the year 1988 and given statutory powers on 12 April 1992 through the SEBI Act, 1992.

HISTORY OF SEBI It was established by the Government of India on 12 April 1988 and given statutory powers in 1992 with SEBI Act 1992 being passed by the Indian Parliament. SEBI has its headquarters at the business district of Bandura Kurla Complex in Mumbai and has Northern, Eastern, Southern and Western Regional Offices in New Delhi, Kolkata, Chennai and Ahmedabad respectively. It has opened local offices at Jaipur and Bangalore and is planning to open offices at Guwahati, Bhubaneshwar, Patna, Kochi and Chandigarh in the Year 2013-2014.

Stock Exchange has been defined as an "association, organization or body of individuals, whether incorporated or not, established for the purpose of assisting, regulating and controlling business of buying, selling and dealing in securities".

3. STATEMENT OF THE PROBLEM

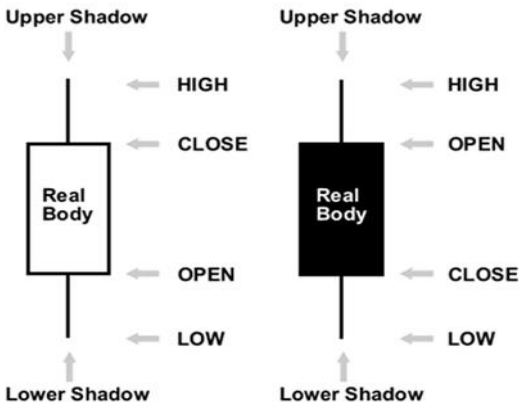
Raising of funds is an important function of the financial manager. Money market is the basic factor for the smooth running of the firm and also for raising funds. The finance manager works actively to increases the share prices of the company in the share market and the share price depends upon the performance of the company. The investors will invest their money in the particular share of the company only after knowing the current position of the company. Hence, the present study is undertaken to analyze Share Price Movements of Bajaj Finance Pvt Ltd and Muthoot Finance Pvt Ltd.

MODEL INTRODUCTION:

JAPANESE CANDLESTICK TRADING

A Westerner by the name of Steve Nison "discovered" this secret technique called "Japanese candlesticks," learning it from a fellow Japanese broker.

Steve researched, studied, lived, breathed, ate candlesticks, and began to write about it.Slowly, this secret technique grew in popularity in the 90's.



To make a long story short, without Steve Nison, candlestick charts might have remained a buried secret. Steve Nison is Mr. Candlestick.

4.PICTURE ABOUT THE JAPANESE CANDLESTICK MODELS

Japanese candlesticks can be used for any time frame, whether it is one day, one hour, 30-minutes – whatever you want!

They are used to describe the price action during the given time frame.

Japanese candlesticks are formed using the open, high, low, and close of the chosen time period.

If the close is above the open, then a hollow candlestick (usually displayed as white) is drawn.

If the close is below the open, then a filled candlestick (usually displayed as black) is drawn.

The hollow or filled section of the candlestick is called the "real body" or body.

The thin lines poking above and below the body display the high/low range and are called shadows.

The top of the upper shadow is the "high".

The bottom of the lower shadow is the "low".

5. SCOPE OF THE STUDY

The study covers a period of years from April 2015 to March 2017

• The study helps to expose an idea about the future trends in the share prices of Bajaj Finance and Motheo Finance Pvt Ltd.

• The study was also helpful for the new investors, researchers, brokers etc., for decision making.

6. OBJECTIVES OF THE STUDY

- To study the Share Price Movements of the selected companies during the period April 2015 to March 2017
- To examine the Growth of the share prices of the selected companies.
- To analyse the volume and other psychological indicators in investors in price levels.

7. NEED FOR THE STUDY

The study of share price movement is useful to know the share price trends of Bajaj Finance and Muthoot Finance Ltd.

- This helps the investors to understand the current position of share prices.
- Share Price Movement of two companies would help the investors to invest their amount in the best profit retaining shares.

8.LIMITATIONS OF STUDY

An attempt has been made to analyze the share price movement of Bajaj finance and Muthoot Finance Pvt Ltd.

The limitations of the study are:

- The findings are based on the collected secondary data for Two years only.
- The required data were taken from BSE website only.

9. NON-BANKING COMPANIES:

A Non-Banking financial company (NBFC) is a company registered under the companies act, 1956 engaged in the business of loans and advances, acquisition of shares, stocks, bonds, debentures, securities issued by government or local authority or marketable securities of a like nature, leasing, hire purchase, insurance etc..,Accordingly two non-banking finance companies namely Bajaj Finance and Muthoot finance were selected for the study

Muthoot Finance: It is an Indian Financial Corporation and also a largest gold financing company and its stocks are listed on the Bombay Stock Exchange (BSE)

and NSE. As of March2017, revenue stood at more than Rs.23000 crore.

Bajaj Finance : The Bajaj Finance is focusing mainly on providing two and three wheeler finance. Bajaj Auto Finance Ltd shares was listed on the BSE and NSE.

10. REVIEW OF LITERATURE ABOUT NON - FINANCIAL BANKING SECTORS

- A review of literature is a test of a research work, which includes the current knowledge including substances, findings as well as theoretical and methodological contribution to a particular topic. It helps to determine the nature of the research. The review of literature related to the research study are thoroughly scrutinized and presented here.
- Abdulsalam Suleiman Olaniyi (2011), "Stock Trend Prediction Using Regression Analysis in a Data Mining Approach" suggested that the regression analysis as a data mining technique and developed tool for exploiting especially time series data in financial institution. A prediction system has been built that uses data mining technique to produce periodically forecast about stock market prices.
- Amarasinghe (2015), "Dynamic Relationship between Interest Rate and Stock Price in Empirical Evidence from Colombo Stock Exchange". The major objective of the study is to identify the dynamic relationship between interest rate and stock prices.
- Chitra (2011), "Technical Analysis on Selected Stocks of Energy Sector". The objective of the study is to conduct Technical Analysis on Selected Stocks and Interpret on whether to buy or sell them, to find out the risk involved with the scrip on par with market using Beta, to analyze price movement using relative strength index, to understand trends and patterns in share price movements using simple moving average
- Nidhi Malhotra and Kamini Tendon (2013), undertook the study about "Determinants of Stock Prices in Empirical Evidence from NSE 100 companies with the objective to review the existing literature by examining the Empirical relationship between stock prices and company specific intrinsic factors, such as dividend per share, earning per share and price earnings ratio are having a significant positive association with firms.
- Oliver Ike Inyiama and ChikeNwoha (2014), conducted a study on "Macro Economic Variables and Share Price Movements in Nigeria" and suggested that the study is significant to policy makers, Regulatory Bodies, Professional Institutes and Associations, Government Agencies, Planning Commissions and Parastatals, Standard Setting Bodies, Research Institutes, Institution of Higher Learning, Financial Institution, Manufacturing and Service Sectors and so on. The study confirms a prior expectation to a reasonable extent.
- Qasem and EmanAlnagi (2013), exercised the study of "Predicting Stock Prices using Data mining Techniques". The main objective is to building the model to try to help the investors in the stock market to decide the best timing for buying or selling stocks based on knowledge extracted from the historical prices of such stocks.
- Sabari Rajan and Parimala (2013), conducted a study on "Stock Price Movement through Technical Analysis

in Empirical Evidence from the Fast Moving Consumer Foods Sector (FMCG)" with the objective to forecast the future trends and provide suitable suggestions to the investors. The study revealed that investor are required to consider the various factor which may affect the psychology of the investors while conducting technical analysis.

- Sakthi Varshney (2014), conducted the study on
- "Technical Analysis of Indian Pharmaceutical companies", an evaluated the Stock Exchanges on the basis of technical indicators. For technical analyses they used secondary data. The period of study was three years (i.e), 01.02.2011 to 01.02.2014. An attempt has been made to forecast the company's return forthcoming period by using the Beta under the Capital Asset Pricing Method (CAPM).The results states that technical analysis helps in evaluating the current trend and risks of the scrip. It helps the investors in understanding the knowledge of financial market and necessary financial inputs for better investment.
- Sanjeet Sharma(2011) in his study on "Determinants of Equity Share Prices in India" examines the empirical relationship between equity share prices and explanatory variables such as: book value per share, dividend per share, earning per share, price earnings ratio, dividend yield, dividend payout, size in terms of sale and net worth for the period 1993-94 to 2008-09. The results revealed that earning per share, dividend per share and book value per share has significant impact on the market price of share. Further, results of study indicated that dividend per share and earnings per share being the strongest determinants of market price, so the results of the study supports liberal dividend policy and suggests companies to pay regular dividends.
- SoundarRajan (2012), conducted a study on "Analysis of Share Price Movements of the Selected Industries based on Nifty Stocks", focuses on the performance of the Share Price movements based on special reference to the NIFTY stocks has been analyzed.
- Suresh (2013), made an attempt to study on "Fundamental and Technical Analysis of Economic Environment for Investment Decision". Fundamental analysis examines the economic environment industry performance and company performance before making an investment decision. The objective of the investors was maximization of return and minimization of risk. Each investor to maximize his welfare by choosing the optimum combination of risk and return in accordance with his preference and capacity. Tools used for the study was Dow Theory, RIS and Moving Average. The various studies concluded the share price movements of the various sectors. Hence a study on share price movements of the selected companies namely Bajaj Finance Ltd and Muthoot Finance Ltd was undertaken.

11. RESEARCH METHODOLOGY

The research methodology is the way to solve the research problems systematically. The analysis was concerned with Share Price Movement of selected companies.

12. RESEARCH DESIGN

A research design is the arrangement of conditions for collection and analysis of data in a manner that aims to

combine relevance to the research purpose with economy in procedure. The design includes an outline of what the researcher will do from writing the hypothesis and its operational implications to the final analysis of data.

13. SELECTION OF SAMPLES

The Samples were selected from Non-Banking industries for the study. The samples are Bajaj Finance Ltd and Muthoot Finance Ltd. Among the listed companies in the Bombay Stock Exchange these two companies which are actively traded in BSE were taken for the study on their market capitalization value.

PERIOD OF THE STUDY

The study was conducted for a period of five years from April 2015 to March 2017.

SOURCES OF DATA

Data was collected from secondary sources. The share prices are taken from the Bombay Stock Market (BSE).

TOOLS USED FOR RESEARCH

- Japan Candlestick Model

JAPAN CANDLESTICK MODEL

Japan Candlestick Model is applied to find out the open and close prices as well as the high and low prices of shares.A Japanese Candlestick chart is the oldest form of technical analysis. Candlestick charts provides the information such as namely open price, high price, low price and close price. However, Candlestick charting provide visual indication of market psychology, market sentiment and potential weakness making it a rather trading tool. Japan Candlestick Model helps a trader to compare the relationship between the open and close prices as well as the high and low prices immediately. The relationship between the open and close is considered vital information and forms the essence of candlesticks. Hollow candlesticks, where the close price is greater than the open price, indicate buying pressure and represent bullish trend.

TOOLS USED FOR PURPOSES

The only focus on Japan candlestick models .

Share Price Movements	To Known about the volatility of share prices.
Moving Average	To Known about the average value of security's price over a period of time.
Japan candlestick model	To analyse the volume and other psychological indicators.
Trend Analysis	To predict the future share price movements.
Growth Analysis	To predict the growth trend of the company's share price.

14. ANALYSIS AND INTERPRETATION

The only focusing on Japan Candlestick Model of the Share Prices in Bombay stock change.

JAPAN CANDLESTICK MODEL

Candlestick charts provide the information such as namely open price, high price, low price and close price However, Candlestick chart provides a visual indication of market psychology, market sentiment and potential weakness making it a rather valuable trading tool. Japan Candlestick Model immediately helps a trader to compare the relationship between the open and close as well as the high and low immediately. The relationship between the open and close is considered vital information and forms the essence of candlesticks. Hollow candlesticks, where the close is greater than the open, indicate buying pressure and represent bullish trend. Filled candlesticks, where the close is less than the open, indicate selling pressure and bearish trend.

JAPAN CANDLESTICK MODEL OF BAJAJ FINANCE 2015-2016

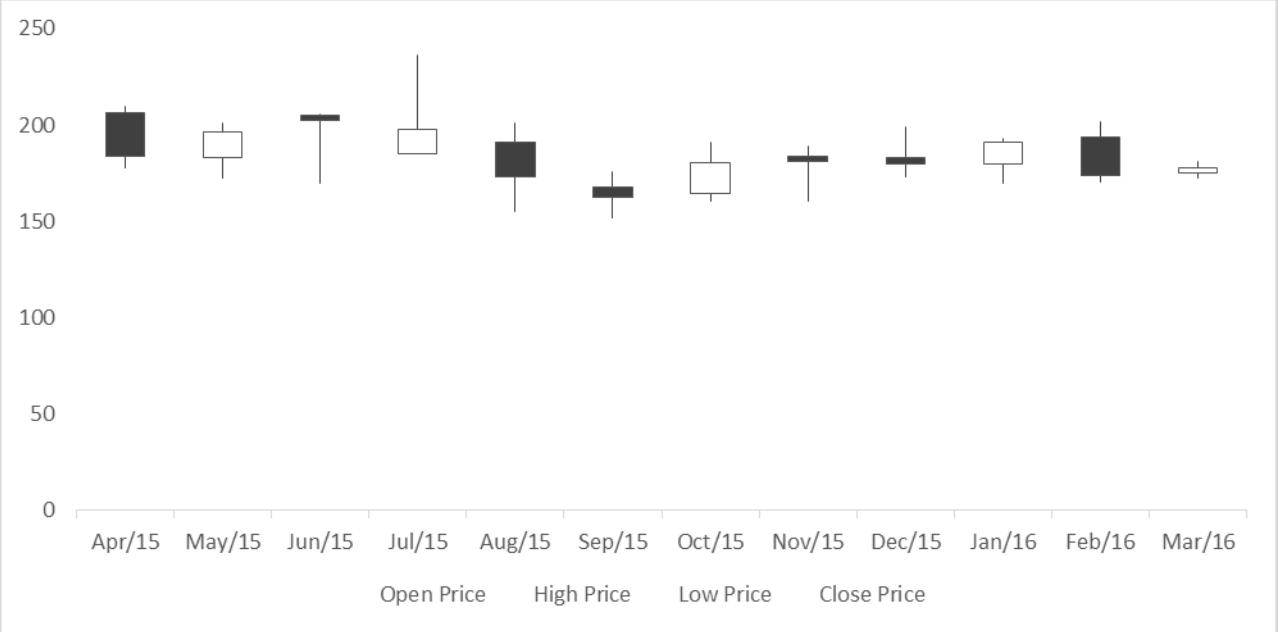
(Figures in Rs)

Month	Open Price	High Price	Low Price	Close Price
Apr-15	206.55	209.90	178.00	183.65
May-15	183.00	201.35	172.55	196.20
June-15	205.00	205.75	170.00	202.20
July-15	185.00	236.50	185.00	197.70
Aug-15	191.05	200.95	155.00	173.20
Sep-15	167.55	176.00	152.00	162.65
Oct-15	164.15	190.95	160.75	180.60
Nov-15	184.00	188.85	160.20	181.15
Dec-15	182.90	199.00	173.00	179.55
Jan-16	180.00	192.90	170.00	191.20
Feb-16	193.90	202.00	170.20	173.85
Mar-16	175.40	181.40	172.50	178.10

Source: Secondary Data

Japan Candlestick Model of Bajaj Finance indicates filled candlesticks, where the close price is less than the open price shows selling pressure and represent bullish trend in year 2015-2016.

JAPAN CANDLESTICK MODEL OF BAJAJ FINANCE 2015-2016



JAPAN CANDLESTICK MODEL OF BAJAJ FINANCE 2016-2017

(Figures in Rs)

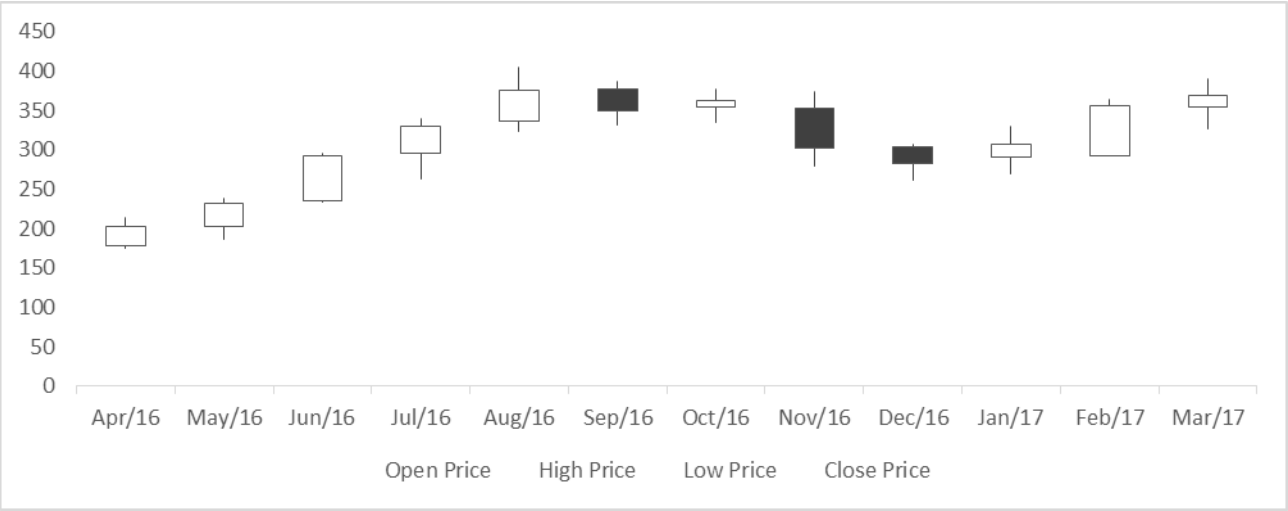
Month	Open Price	High Price	Low Price	Close Price
Apr-16	177.80	213.50	175.50	202.70
May-16	202.75	238.85	186.00	232.35
June-16	234.65	294.85	232.95	292.35
July-16	295.00	340.00	263.00	329.85
Aug-16	337.00	405.35	323.40	375.55
Sep-16	377.00	387.00	331.35	349.85
Oct-16	354.00	376.90	335.00	363.30
Nov-16	352.00	373.50	280.00	301.55
Dec-16	303.00	307.65	261.05	282.25
Jan-17	290.00	329.80	270.10	306.40
Feb-17	291.90	364.30	291.90	355.55
Mar-17	354.00	389.90	326.65	369.40

Source: Secondary Data

Japan Candlestick Model of Bajaj Finance indicates filled candlesticks, where the close price is greater than the open price shows buying pressure and represent bullish trend in year 2016-2017.

Exhibit No:5

JAPAN CANDLESTICK MODEL OF BAJAJ FINANCE 2016-2017



JAPAN CANDLESTICK MODEL OF MUTHOOT FINANCE 2015-2016

JAPAN CANDLESTICK MODEL OF BAJAJ FINANCE 2016-2017

(Figures in Rs)

Month	Open Price	High Price	Low Price	Close Price
Apr-16	177.80	213.50	175.50	202.70
May-16	202.75	238.85	186.00	232.35
June-16	234.65	294.85	232.95	292.35
July-16	295.00	340.00	263.00	329.85
Aug-16	337.00	405.35	323.40	375.55
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Dec-16	303.00	307.65	261.05	282.25
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Japan Candlestick Model of Bajaj Finance indicates filled candlesticks, where the close price is greater than the open price shows buying pressure and represent bullish trend in year 2016-2017.

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JAPAN CANDLESTICK MODEL OF BAJAJ FINANCE 2016-2017

JAPAN CANDLESTICK MODEL OF MUTHOOT FINANCE 2015-2016

(Figures in Rs)

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June-15	205.00	205.75	170.00	202.20
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Dec-15	182.90	199.00	173.00	179.55
Jan-16	180.00	192.90	170.00	191.20
Feb-16	193.90	202.00	170.20	173.85
Mar-16	175.40	181.40	172.50	178.10

Source: Secondary Data

Japan Candlestick Model of Muthoot Finance indicates filled candlesticks, where the difference between the open price and the close price shows a fluctuating trend and represent bullish trend in year 2015-2016.

JAPAN CANDLESTICK MODEL OF MUTHOOT FINANCE 2015-2016

JAPAN CANDLESTICK MODEL OF MUTHOOT FINANCE 2016-2017

(Figures in Rs)

Month	Open Price	High Price	Low Price	Close Price
Apr-16	177.80	213.50	175.50	202.70
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Mar-17	354.00	389.90	326.65	369.40

Source: Secondary Data

Japan Candlestick Model of Muthoot Finance indicates filled candlesticks, where the close price is greater than the open price shows buying pressure and represent bullish trend in year 2016-2017.

JAPAN CANDLESTICK MODEL OF MUTHOOT FINANCE 2016-2017

15. FINDING, SUGGESTIONS AND CONCLUSION

JAPANESE CANDLESTICK METHOD

Bajaj Finance

For 2015-2016

Japan Candlestick Model of Bajaj Finance indicates filled candlesticks, where the close price is less than the open price shows selling pressure and represent bullish trend in year 2015-2016.

For 2016-2017

Japan Candlestick Model of Bajaj Finance indicates filled candlesticks, where the close price is greater than the open price shows buying pressure and represent bullish trend in year 2016-2017.

Muthoot Finance

For 2015-2016

Japan Candlestick Model of Muthoot Finance indicates filled candlesticks, where the difference between the open price and the close price shows a fluctuating trend and represent bullish trend in year 2015-2016.

For 2016-2017

Japan Candlestick Model of Muthoot Finance indicates filled candlesticks, where the close price is greater than the open price shows buying pressure and represent bullish trend in year.

16. SUGGESTIONS

- ✓ The investors should have through knowledge about the market trend and share price movement before investing in stock market.
- ✓ To have a better return, the investors must analyse a market trend at least for four to five years. This will help them to minimize the risk and also to forecast the future price movement of the selected stock.
- ✓ As per the study it is suggested that the investment in shares of Muthoot Finance is better.

CONCLUSION

In the present globalized scenario, the health of stock exchange is solely depends on the pattern of investment by the investors. Investment is a financial activity that involves risk. It is the commitment of funds for a return expected to be realized in the future. Investments may be made in financial assets or physical assets. In either case there is a possibility that the actual return may vary from the expected return and the possibility of the risk involved in the investment. As the financial market faces quick changes, investors should seek for right opportunities keeping in tune with the dynamics of market environment. Financial market reflects a country's economic growth as they supply necessary financial inputs for the development of the country. In this study, researcher has analyzed the share price movements of non-banking financial companies namely (Bajaj Finance Pvt Ltd and Muthoot Finance Pvt Ltd). The technical indicator, Japanese Candlestick Method, reveals the direction and share prices movements of selected companies. The study reveals that there is a possibility of getting benefits by investing in the shares of Muthoot Finance. It gives an idea of future share price trends of the companies.

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A Literature Survey on Dual Authentication and Key Management Techniques for Secure Data Transmission in Vehicular Ad Hoc Networks

Ms.B.Manimekala[1], Prof Dr.R.Ravichandran[2]

Abstract

Vehicular ad hoc networks (VANETs) are an important communication paradigm in modern-day mobile computing for exchanging live messages regarding traffic congestion, weather conditions, road conditions, and targeted location-based advertisements to improve the driving comfort. In such environments, security and intelligent decision making are two important challenges needed to be addressed. In this paper, a trusted authority (TA) is designed to provide a variety of online premium services to customers through VANETs. Therefore, it is important to maintain the confidentiality and authentication of messages exchanged between the TA and the VANET nodes. Hence, we address the security problem by focusing on the scenario where the TA classifies the users into primary, secondary, and unauthorized users. In this paper, first, we present a dual authentication scheme to provide a high level of security in the vehicle side to effectively prevent the unauthorized vehicles entering into the VANET. Second, we propose a dual group key management scheme to efficiently distribute a group key to a group of users and to update such group keys during the users' join and leave operations.

In the proposed dual key management is that adding/revoking users in the VANET group can be performed in a computationally efficient manner by updating a small amount of information. The results of the proposed dual authentication and key management scheme are computationally efficient compared with all other existing schemes discussed in literature, and the results are promising.

Keywords: Vehicular Adhoc network, Trusted Authority, Primary User, dual key

1. INTRODUCTION

The life of VANET lies in the communication that takes place between different vehicles. The data being gathered and exchanged by the vehicles requires some protocols or rules through which transmission can take place in a systematic and organized way. The data exchange between nodes in a VANET happens via routing protocols. These protocols define how a packet of data will be distributed among different nodes. VANET usually incorporate Trusted Authority (TA) that is meant to source online premium service to nodes in network. It is required to keep up the authentication and confidentiality of the messages transmitted between the

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TA and nodes. A Trusted Authority (TA) is designed to provide a variety of online premium services to customers through VANETs. Therefore, it is important to maintain the confidentiality and authentication of messages exchanged between the TA and the VANET nodes. Hence, we address the security problem by focusing on the scenario where the TA classifies the users into primary, secondary, and unauthorized users.

2. PROBLEM STATEMENT

- The security issues and challenges where TA classifies the VANET nodes into primary, secondary and unauthorized users
- The communication overhead increases when the density of vehicles is higher.
- The main limitation of this method is that if there is no verifier to verify messages, then the malicious messages may be consumed by vehicle users.
- All these schemes fail to propose an integrated approach to provide the authentication as well as confidentiality services in VANET.
- Take more computational time
- Vulnerable to various attacks (i.e. Sybil Attack, Collusion Attack)

3. LITERATURE SURVEYS

Shen, et al., published a paper on “Cooperative message authentication in vehicular cyber-physical systems”[6]. In this scheme, CMAP which stands for cooperative message authentication protocol is used. It is for finding out the malicious data being broadcasted in the road transport system by the unauthorized vehicles. This favorable technique called cooperative message authentication is used to reduce the computational overhead required for verification of the messages. As the number of vehicle increases in the road transport system, the communication overhead also increases. The main disadvantage of this scheme is that there is no verifier in the system to verify the messages, so the unwanted messages will be communicated between the vehicles.

Perring et al., publication is “The TESLA broadcast authentication protocol”. This scheme introduced a protocol with the name timed efficient stream loss-tolerant authentication (TESLA) protocol[7]. This protocol uses symmetric keys for encrypting and decrypting the messages instead of using the asymmetric keys. Symmetric key system uses same key at both the sender and receiver side. Denial of service attacks will be prevented in this scheme as the symmetric keys are being used which are proved to be faster than the signatures. But the limitation of this scheme is that non-repudiation cannot be achieved using symmetric keys.

“A group signature based secure and privacy preserving vehicular communication framework” published by [8]J. Gua, J. P. Baugh and S. Wang . In this scheme, group signature technique is used to provide the security to the messages being communicated between the vehicles in the VANET. Here, public key of one group will be connected with the private keys of the multiple groups. In this particular group signature method, it is easy for an attacker to find out the group from which the message is sent but the sender of the message cannot be tracked.

[9]C. Wong, M. Gouda and S. Lam published a paper with the title “Secure group communications using key graphs” . A novel solution for the scalability problem is presented in this scheme of work. As the scalability to the different groups is the biggest problem seen in the

network, a concept called key graph is introduced here for the groups. Secure distribution of the rekeying messages is also included in this strategy which will be conducted as a join and leave operation takes place in the system. These join and leave protocols of the rekeying process is implemented in a prototype key server built by them. The main disadvantage of this scheme is that it has high computational complexity.

X. L. Zheng, C. T. Huang, and M. Matthews published a paper on "Chinese remainder theorem based group key management"[10]. In this scheme, a two centralized group key management protocols is proposed based on the Chinese remainder theorem (CRT). Here the number of the messages broadcasted for distributing the group keys to the vehicle users is minimized. Key computation time is reduced. Key computation overhead of the vehicle users is also minimized. The main drawback of this system is it introduces high computational complexity on the server during key generation process.

They are conducted on VANETs which worked on the schemes that provide authentication only. One of the approach used in existing system Anonymous Batch authentication which provides value-Added Services to VANET's .This scheme was introduced to verify miscellaneous requests which are forwarded from distinct vehicles. It authenticates multiple requests efficiently by a single authentication operation. The main issue with this system was scalability problem. Another approach was to provide secure group communication using key graphs Here key graphs are introduced to specify secure groups. Three strategies are defined for distributing rekey messages securely after a join/leave. [17]The Group key management service is scalable to large groups with frequent joins and leave operations. The major drawback with this system is the usage of user-oriented rekeying on the sever side and group oriented rekeying on the client side which effects the performance. Next approach is a Group Signature Based Secure and Privacy-Preserving Vehicular Communication Framework. It achieves authenticity, data integrity, anonymity, and accountability at the same time. It provides authenticity and ensures secrecy of the data. Here Vehicles use their own identity. A Scalable Robust Authentication protocol for Secure Vehicular Communications[19] is another technique proposed by Sun et.al., publishers. In this system each RSU maintains and manages an on-the-fly group within its communication range. Here vehicles broadcast V to V messages, which are verified instantly by the vehicles in the same group. It uses an ID-based cryptography which actually increases storage space. [6]Co-operative Message Authentication (CMAP) is another approach which identifies malicious information that is being broadcasted by a malicious user. The main disadvantage of this system is that if no verifier is present then the malicious information can be broadcasted to legitimate users also. Yet another approach Certificate Management Scheme for Vehicular Networks which offers a flexible way of certificate management as well as provides a way for OBU's to update the certificate anywhere at any time. This system can reduce the complexity of certificate management and can achieve excellent security. Major

drawback of this system is long delay incurred in checking the revocation status of a certificate.

Yong Hao proposed [5]A Distributed Key Management Framework With Co-operative Message Authentication in VANET which is to tackle the large computation overhead due to the group signature implementation. A cooperative message authentication protocol [9] is proposed to alleviate the verification burden. Malicious vehicle cannot enter into VANET and privacy is preserved. Security attacks are possible. A. Dhamgaye and N. Chavhan proposed a scheme which routes the data efficiently from source to destination[2]. Many protocols such as Proactive and Reactive routing Protocols, Source routing or hop by hop routing is used. It selects the best path with least time and least expensive route. The best route from source to destination is found. Different types of attack on routing protocols in VANET. Irfan Syamsuddina, Tharam Dillonb, Elizabeth Changc, and Song Hand which is used to tackle the security and the privacy problems in RFID communications. There are several protocols have been proposed to overcome those problems. Hash chain is commonly employed by the protocols to improve security and privacy for RFID authentication. Although the protocols able to provide specific solution for RFID security and privacy problems, they fail to provide integrated solution.

WENLONG SHEN, LU LIU, XIANGHUI CAO (Member, IEEE), YONG HAO AND YU CHENG (Senior Member, IEEE) proposed a scheme which is used to tackle large computation overhead caused by the safety message authentication. A cooperative message authentication protocol (CMAP) is developed to alleviate vehicles' computation burden. All the vehicles share their verification results with each other in a cooperative way, so that the number of safety messages that each vehicle needs to verify reduces significantly. Security is the major issue. Huang, Misra, Verma, Xue proposed a scheme which is used to solve the generation of pseudonyms for anonymous communication. We have proposed a novel PACP (Pseudonymous Authentication-Based Conditional Privacy Protocol for VANETs) protocol for the vehicles in VANETs for such that the pseudonyms are only known to the vehicles but have no other entities in the network. Confidential privacy is provided to the vehicles. It is suitable only for small scale VANET test bed.

Jiun-Long Huang proposed an ABAKA (An Anonymous Batch Authenticated and Key Agreement Scheme) which is to tackle the problems, including security, efficiency, and scalability problem. ABAKA scheme is to build a secure environment for value-added services in VANETs[3]. The concept of batch verification to authenticate multiple requests sent from different vehicles using elliptic curve cryptography (ECC). ABAKA scheme to authenticate multiple requests sent from different vehicles and establish different ensure the confidentiality session keys. ABAKA is a suitable scheme for value-added services in VANETs. Stefano Busanelli, Gianluigi Ferrari, and Luca Veltri propsed a Short-lived Key Management scheme which is used to tackle the problems such as connectivity is limited and communication with a central certification authority might be problematic [15]. The group-keys are derived from a couple of independent

hash chains for generating onetime passwords.MD-5, SHA-1.Symmetric cryptographic algorithm to offer group-level confidentiality and group level integrity services. No per-user authentication and non-repudiation is provided.

4. METHODS AND MATERIAL

A.PREVIOUS WORK

- Centralized Time Division Multiple Access (TDMA) based scheduling protocol based on a new weight-factor-based scheduler in a Vehicular network. A Roadside Unit (RSU), is a centralized controller, which collects the state information of a channel and also the individual information of the communication links within its communication coverage. It then calculates their respective scheduling weight factors followed by scheduling decisions, which are made by the RSU. The Scheduling weight factor has three parts, namely the channel quality factor, the speed factor, and the access category factor. In this system, a resource-reusing mode can be permitted among multiple vehicle-to-vehicle (V2V) links, provided the distances between the two vehicles of these V2V links are greater than a predefined interference interval. The centralized TDMA-based scheduling protocol in this system can improve the network throughput when it is compared with the existing system, medium-access-control protocols in vehicular networks, and can be easily incorporated into practical vehicular networks.
- The RFID authentication protocols which provides privacy and anonymity. Hash chain method is used in these RFID authentication protocols in various ways and it provides a unique solution for security and also for privacy problems of RFID technology. As a result, while problems in particular cases can be addressed, other problems tend to occur. Thus, the proposed system can be concluded that recent RFID authentication protocols with hash chain failed to satisfy an integrated security and privacy solutions for RFID.
- Many existing techniques are available in the literature for providing authentication in the VANET. Among the various existing techniques, Johnson et al. proposed an Elliptic Curve Digital Signature Algorithm (ECDSA), which is mathematically derived from the basic digital signature algorithm.
- ECDSA uses an asymmetric key pair which consists of a public key and a private key. The public key used in this technique is a random multiple of the base point, where the multiples are generated from the private key. Here, both the public and the private keys are used for user authentication.

B. PROPOSED WORK

We proposed a new dual authentication scheme for improving the security of vehicles that are communicating with the VANET environment. For providing such authentication in dual mode, we used two components such as hash code and fingerprint, finger knuckle of each communicating vehicle user. Therefore, the fingerprint authentication technique is integrated into a hash code creation method in this paper to avoid malicious users to use the secret key of any VANET users

in order to participate in the VANET communication. Moreover, to avoid malicious users from spoofing the authentication code issued for any VANET users and sending erroneous messages to other

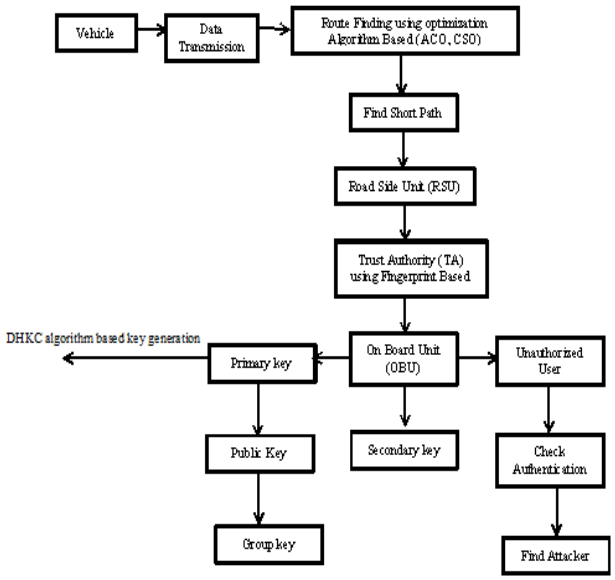

Fig 1. Proposed Work Flow

vehicles we have introduced a new dual key management scheme in this research work. The main objective of developing a dual authentication scheme is to improve the security in the vehicle side. The dual authentication scheme depends on the Vehicle Secret Key (VSK) which is given to the user at the time of registration by the Trusted Authority.

C. ADVANTAGES OF PROPOSED SYSTEM

The proposed dual group key management scheme minimizes the computational cost of the TA and group Members in the rekeying operation. To achieve this goal, the TA performs only simple addition and subtraction operations to update the group key. Similarly, each vehicle user of the multicast group performs only one modulo division operation for recovering the updated key when the group membership changes.

- We propose a secure dual authentication technique with the capability of preventing malicious vehicles entering into the VANET system.
- We introduce a dual key management technique into the VANET to disseminate the information from the TA side to the group of vehicle users in an intelligent and secure way.
- We get the computational complexity of our proposed dual key management scheme as O (1) in both the TA and vehicle users and hence it is suitable for VANETs.
- The communication complexity of our proposed dual key management scheme is also O (1) which means that our scheme takes only one broadcast to inform the updated keying information from the TA to vehicle group.
- Even if the VSK value of any user is lost, the intruder cannot use that VSK for getting service from the TA. To prevent the intruder to use other users VSK, we have included fingerprint of each authenticated user in the smart card issued by the TA.
- Moreover, the proposed dual authentication technique is a computationally efficient authentication technique.
- The computation complexity of the TA and VANET user is reduced substantially by minimizing the number of arithmetic operations taken by the TA and VANET user.
- Decrease computation time
- Provide data security
- Decrease storage consumption

CONCLUSION

In this paper, we proposed a dual authentication scheme to authenticate both the OBU and authority for an authorized the users entering into the network. We manage key techniques for secure data transmission smart card device in vehicular ad hoc networks. The dual group key management scheme to efficiently distribute a group key to a group of users and to update such group keys during the users join and leave operations. The primary user will directly link with the authority and secondary users receive the information from the primary user. It also has been verified by the primary user by the group key. The future development of this project provides a numbers for authentication but in future strings will be used for authentication purpose and transmit text messages to the users, in future system will transmit images and videos too to the users.

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A New Approach for Decision Making Using Intuitionistic Fuzzy Sets

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Abstract

A new approach named as Intuitionistic fuzzy Max-min average composition method for decision making is proposed to study the disease diagnosis based on the test results. Sanchez's approach for decision making is studied and the concept is modified by the application of Fuzzy Set theory. Through a survey the composite relations between the patients, symptoms and diseases are discussed. The proposed method is compared with max-min composition method.

1. INTRODUCTION

In the present paper it study the Sanchez's (1976, 1977) method using the notion of IFS theory, the degrees of membership and non-membership are a single value between 0 and 1. However, in reality, it may not always be certain that the sum of the degrees is just 1 Atanassov, (1995) and Biswas (1997). Fuzzy set theory has a number of properties that make it suitable for decision making. There are two popular techniques for decision making using Sanchez's approach. One is the method that uses the max-min composition rule. The other is the method that uses the distance measure between fuzzy sets for Decision making.

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Intuitionistic fuzzy sets [IFSs] as a generalization of fuzzy sets, it was introduced by Zadeh, (1965) and K. Atanassov (1989,1995) which contains three functions namely, membership non membership and hesitancy. The hesitancy plays an important role in determining medical diagnosis. For example, in decision making problems, in the case of medical diagnosis[8,9], sales analysis, Enterprise planning, Network Security analysis Sales and marketing services, etc. there is a fair chance of the existence of a non-null hesitation part at each moment of evaluation of an unknown object.In this paper Intuitionistic fuzzy sets is used as a tool for reasoning in the presence of imperfect facts and precise knowledge. In max-min composite relation method Supriya Kumar *et al* (2001) Edward Samuel and M. Balamurugan (2012) an attempt is made to provide a formal model of the process to identify the diseases of the patients based on the four main types of diseases. The techniques summarize the simulation results to compare the outcomes of the diagnosis techniques by using IFS theory and implement it in the form of field recommendation system. This is the system by which the doctors use his knowledge to infer the diseases from the symptoms, based on his test results.

2. PRELIMINARIES

The basic definitions of Intuitionistic fuzzy set theory that are useful for subsequent discussions are given.

❖ Definition 2.1: A set E be fixed. An IFS A in E is an object having the form

A= $\{\langle x, \mu_A(x), \nu_A(x)\rangle | x \in E\}$, Where the functions $\mu_A : E \to [0,1]$ and $\nu_A : E \to [0,1]$ define the degree of membership and degree of non-membership respectively of the element $x \in E$ to the set A, which is a subset of E, and for every $x \in E$, $0 \le \mu_A(x) + \nu_A(x) \le 1.$

The amount $\pi_A(x) = 1 - (\mu_A(x) + \nu_A(x))$ is called the hesitation part, which may cater to either membership value or non-membership value or both.

❖ Definition 2.2: If A and B are two Intuitionistic fuzzy sets of the set E, then

$A \subset B$ iff $\forall x \in E, \quad [\mu_A(x) \le \mu_B(x) \text{ and } \nu_A(x) \ge \nu_B(x)],$

$A \subset B$ iff $B \subset A$,

$A = B$ iff $\forall x \in E, [\mu_A(x) = \mu B(x) \text{ and } \nu_A(x) = \nu_B(x)],$

$A = \{\langle x, \nu_A(x), \mu_A(x)\rangle | x \in E\}$

$A \cap B = \{\langle x, \min(\mu_A(x), \mu_B(x)\rangle, \max(\nu_A(x), \nu_B(x)) | x \in E\}$

$A \cup B = \{\langle x, \max(\mu_A(x), \mu_B(x)\rangle, \min(\nu_A(x), \nu_B(x)) | x \in E\}$

Clearly every fuzzy set has the form $\{\langle x, \mu_A(x), \mu_{A^c}(x)\rangle | x \in E\}$

❖ Definition 2.3: Let X and Y be two sets. An Intuitionistic fuzzy relation (IFR) R from X to Y is an IFS of $X \times Y$ characterized by the membership function μ_R and non-membership function ν_R. An IFR R from X to Y will be denoted by $R(X \to Y)$.

❖ Definition 2.4: If A is AN IF of X, the max-min-composition of the relation $R(X \to Y)$ with A is an IFS B of Y denoted by $B = R \circ A$, and is defined by the membership function

$$\mu_{R \circ A}(y) = \bigvee_x [\mu_A(x) \wedge \mu_R(x, y)]$$

and the non-membership function

$$\nu_{R \circ A}(y) = \bigwedge_x [\nu_A(x) \vee \nu_R(x, y)] \quad \forall y \in Y$$

$(where \wedge = \min, \vee = \max)$

❖ Definition 2.5: Let $Q(X \to Y)$ and $R(Y \to Z)$ be two IFRs. The max-min-max composition $R \circ Q$ is the Intuitionistic fuzzy relation from X to Z, described by the membership function

$$\mu_{R \circ Q}(x, z) = \bigvee_y [\mu_Q(x, y) \wedge \mu_R(y, z)]$$

and the non-membership function

$$\nu_{R \circ Q}(x, z) = \bigwedge_y [\nu_Q(x, y) \vee \nu_R(y, z)]$$

$\forall (x, z) \in X \times Z \text{ and } \forall y \in Y.$

❖ Definition 2.6. Let $Q(X \to Y)$ and $R(Y \to Z)$ be two IFRs. The max-min-average composition $R \circ Q$ is the Intuitionistic fuzzy relation from X to Z, described by the membership function

$$\mu_T(p_i, d) = \bigvee_y \left\{ \frac{1}{2} \left[\mu_Q(p_i, s) + \mu_R(s, d) \right] \right\}$$

The non-membership function is

$$\nu_T(p_i, d) = \bigwedge_y \left\{ \frac{1}{2} \left[\nu_Q(p_i, s) + \nu_R(s, d) \right] \right\}$$

$\forall pi \in p \text{ and } d \in D$

and the hesitation function is

$$\pi_T(p_i, d) = \bigwedge_y \left\{ \frac{1}{2} \left[\pi_Q(p_i, s) + \pi_R(s, d) \right] \right\}$$

3. MAX-MIN AVERAGE COMPOSITION METHOD FOR DECISION MAKING:

An application of Intuitionistic Fuzzy set theory using Max-min average composite relation method for decision making is presented.

In a given set of system, let P={x1, x2,….,xn} be the set of patients and S= {y1, y2,….,yn} be the set of symptoms and D ={z1, z2,….,zn} be the set of diseases. Using composition relation in mathematical Analysis, the Intuitionistic Fuzzy relation R from the set of symptoms to the set of diseases D is formed. This relation reveals the degree of association and the degree of non-association between the symptoms and diseases.

The proposed method is based on the following three steps.

Determination of symptoms

Formulation of Intuitionistic Fuzzy relation

Classification of opportunities on the basis of composition of Intuitionistic Fuzzy relations

An Intuitionistic Fuzzy relation Q is given from the set of patients X to the set of symptoms Y and another Fuzzy relation R is given from the set of symptoms Y to the set of diagnoses Z. the composite function T from the Intuitionistic Fuzzy relation R and Q.

3.1 ALGORITHM

Step 1: Form the Intuitionistic Fuzzy relation $Q(P \to S)$

Step 2: Take the Intuitionistic fuzzy relation $R(S \to D)$ (hypothetical)

Step 3: Find the composition function $T = R \circ Q$ describes the state of patients P in terms of the selection as an IFR from P(patients) to D(diseases) given by the membership, the non-membership and the hesitation function is

$$\mu_T(p_i,d) = \bigvee_y \left\{ \frac{1}{2} \left[\mu_Q(p_i,s) + \mu_R(s,d) \right] \right\}$$

$$v_T(p_i,d) = \bigwedge_y \left\{ \frac{1}{2} \left[v_Q(p_i,s) + v_R(s,d) \right] \right\}$$

$\forall pi \in p \text{ and } d \in D$

$$\pi_T(p_i,d) = \bigwedge_y \left\{ \frac{1}{2} \left[\pi_Q(p_i,s) + \pi_R(s,d) \right] \right\}$$

Step 4: Calculate $S_T = \mu_T - v_T$

Step 5: Calculate $S_T = \mu_T - \min\{v_T, \pi_T\}$ using step-3.

3.2 CASE STUDY

The test results of four patients Amity, John, Peter, and Ram are considered for the case study. In the discrimination analysis, the symptoms are ranked according to the grades of each diseases by a particular symptoms and is represented in the form of a matrix called a frequency distribution matrix m={aij} where aij is the Intuitionistic Fuzzy value of the patients X with diseases Z and symptoms Y to the total number of patients with diseases.

Let X={ Amity, John, Peter, Ram} be set of four patients, Y= { temperature, headache, stomach pain, cough} be the set of symptoms and Z= {Viral Fever, Malaria, Typhoid, Stomach Problem} be the set of diseases.

Table 1: Determination of symptoms by using Intuitionistic fuzzy relation $Q(P \to S)$ in entries as per the survey are in the form of IFS (μ_A, ν_A)

Q	Temperature	Head Ache	Stomach Pain	Cough
Amity	(0.8, 0.1,)	(0.6, 0.1)	(0.2, 0.8)	(0.6, 0.1)
John	(0.0, 0.8)	(0.4, 0.4)	(0.6, 0.1)	(0.1, 0.7)
Peter	(0.8, 0.1)	(0.8, 0.1)	(0.0, 0.6)	(0.2, 0.7)
Ram	(0.6, 0.1)	(0.5, 0.4)	(0.3, 0.4)	(0.7, 0.2)

Table 2: Intuitionistic fuzzy relation $R(S \to D)$ gives collections of an approximate description of the patient-symptoms in the hospital in the form of IFS (μ_A, ν_A)

R	Viral Fever	Malaria	Typhoid	Stomach Problem
Temperature	(0.7,0.0)	(0.7, 0)	(0.3, 0.3)	(0.1, 0.7)
Head Ache	(0.3, 0.5)	(0.2, 0.6)	(0.6, 0.1)	(0.2, 0.4)
Stomach Pain	(0.1, 0.7)	(0.1, 0.9)	(0.2, 0.7)	(0.8, 0.0)
Cough	(0.4, 0.3)	(0.7, 0.0)	(0.2, 0.6)	(0.2, 0.7)

Table 3: Represents the Determination of diseases by using the max-min average composition $T = R \circ Q$.

T	Viral Fever	Malaria	Typhoid	Stomach Problem
Amity	(0.75, 0.05)	(0.75, 0.05)	(0.6, 0.1)	(0.5, 0.25)
John	(0.35, 0.4)	(0.4, 0.35)	(0.5, 0.25)	(0.7, 0.05)
Peter	(0.6, 0.05)	(0.75, 0.05)	(0.7, 0.1)	(0.50, 0.25)
Ram	(0.55, 0.05)	(0.7, 0.05)	(0.55, 0.2)	(0.55, 0.2)

Table 4: The difference between membership and non membership values $S_T = \mu_T - \nu_T$ using Table-3

S_T	Viral Fever	Malaria	Typhoid	Stomach Problem
Amity	0.70	0.70	0.50	0.25
John	0.0	0.05	0.25	0.65
Peter	0.55	0.70	0.60	0.15
Ram	0.50	0.65	0.35	0.35

Table 5: Reduces the row wise repetitions by using the relations $S_T = \mu_T - \min\{\nu_T, \pi_T\}$ using Table-3.

S_T	Viral Fever	Malaria	Typhoid	Stomach Problem
Amity	0.70	0.75	0.50	0.25
John	0.10	0.15	0.25	0.65
Peter	0.55	0.70	0.60	0.15
Ram	0.50	0.65	0.35	0.35

CONCLUSION

Clearly the max-min average composition method and max min composition method Edward Samuel and M. Balamurugan (2012) gives the same result of the patients and the diseases. From Table 4 and Table 5, it is seen that the max value of Amity, Peter and Ram is 0.75,0.70 and0.65, the doctors agrees that Amity, Peter and Ram are suffer from malaria whereas the max value of John is 0.65, he is affected by the Stomach Problem. As a result, our approach makes it possible to introduce weights for all symptoms and reduces the confusion about the possibility of two diseases in a patient and also it is an efficient tool for decision making problem.

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Emerge of Cloud applications in IT industry and Human Resource Management

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Abstract

Cloud Storage is a service where data is remotely maintained, managed, and backed up. The service allows the users to store files online, so that they can access them from any location via the Internet. The major differences that are provided by cloud technology and its detailed significance will be analysed. The major cloud services provided are Software as a Service, Platform as a Services and infrastructure as a service The various cloud technology service providers are Sales force, Amazon web services, Google applications, Microsoft Azure and red hot open shift. The analysis will also cover the major significance of cloud technology from customer point of view, followed by significance of other applications and comparison of cloud technology with others. The analysis will also list the service based organizations that are moving towards cloud technologies very fast such as Accenture, Infosys, Cognizant and Tata consultancy services.

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Coding part is hugely reduced, this in turn reduced the development time, reduced effort, and reduced cost, and this increased the customer to rely more on cloud based Sales force applications. Similarly each of the cloud technologies

has their own advantages over traditional applications. The cloud technologies which are used in our day today activities will also be analysed.

2. INTRODUCTION

Now, the IT world and its clients is moving towards the cloud technology. Cloud technology offers simplified operations, easily scalable application, third party information from systems can be accessed through Application programming interface and Costs are reduced to a greater extent. Unlike, Traditional applications i.e. desktop application need a separate software to be installed in a client system and network connectivity is used to access the data from the server. Cloud application can be accessed from anywhere and without installing a software in client machine. It can be accessed only with the help of a browser and an internet connection. It can also be accessed from mobiles, tablet and

laptops. Cloud applications operates through a data stored and computed at regular intervals through a remote server operated by a third party organizations which provide cloud services. The major cloud services provided are Software as a Service, Platform as a Services and infrastructure as a service. Major Infrastructure as a service providers are Amazon web services and Microsoft Azure. Major 'Platform as a Services' providers are Apprenda, red hat open shit and Major 'Software as a Service' providers are Google applications and Salesforce. The scalability, Database operations , cost reduction can be managed effectively through cloud based applications also cloud based technologies can be maintained up to date features as it is updated automatically by the service providers and no manual updates are required from the client or the customer aspect. These are few major aspects of cloud applications over the traditional desktop or web applications.

Various Service models in Cloud Computing

- Infrastructure as a service (IaaS)
- Software as a service (SaaS)
- Platform as a service (PaaS)

Infrastructure-, platform- and software-as-a-service, but these need not be related. For example, one can provide SaaS implemented on physical machines (bare metal), without using underlying PaaS or IaaS layers, and conversely one can run a program on IaaS and access it directly, without wrapping it as SaaS.

1.1 INFRASTRUCTURE AS A SERVICE (IaaS)

IaaS refers to online services that provide high-level APIs used to dereference various low-level details of underlying network infrastructure like physical computing resources, location, data partitioning, scaling, security, backup etc. A hypervisor runs the virtual machines as guests. Pools of hypervisors within the cloud operational system can support large numbers of virtual machines and the ability to scale services up and down according to customers' varying requirements. Linux containers run in isolated partitions of a single Linux kernel running directly on the physical hardware. Containerisation offers higher performance than virtualization, because there is no hypervisor overhead. Also, container capacity auto-scales dynamically with computing load, which eliminates the problem of over-provisioning and enables usage-based billing. IaaS clouds often offer additional resources such as a virtual-machine disk-image library, raw block storage, file or object storage, firewalls, load balancers, IP addresses, virtual local area networks (VLANs), and software bundles. IaaS Service providers: Amazon web services and Microsoft Azure.

1.2 PLATFORM AS A SERVICE (PaaS)

The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages, libraries, services, and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly configuration settings for the application-hosting environment. PaaS vendors offer a development environment to application developers. The provider typically develops toolkit and standards for development and channels for distribution and payment. In the PaaS models, cloud providers deliver a computing platform, typically including operating system, programming-language execution environment, database, and web server. Application developers can develop and run their software solutions on a cloud platform without the cost and complexity of buying and managing the underlying hardware and software layers. PaaS service providers - Microsoft Azure, Oracle Cloud Platform and Google App Engine.

1.3 SOFTWARE AS A SERVICE (SaaS)

In the software as a service (SaaS) model, users gain access to application software and databases. Cloud providers manage the infrastructure and platforms that run the applications. SaaS is sometimes referred to as "on-demand software" and is usually priced on a pay-per-use basis or using a subscription fee. In the SaaS model, cloud providers install and operate application software in the cloud and cloud users access the software from cloud clients. Cloud users do not manage the cloud infrastructure and platform where the application runs. This eliminates the need to install and run the application on the cloud user's own computers, which simplifies maintenance and support. Cloud applications differ from other applications in their scalability—which can be achieved by cloning tasks onto multiple virtual machines at run-time to meet changing work demand. Load balancers distribute the work over the set of virtual machines. This process is transparent to the cloud user, who sees only a single access-point. To accommodate a large number of cloud users, cloud applications can be multitenant, meaning that any machine may serve more than one cloud-user organization. The pricing model for SaaS applications is typically a monthly or yearly flat fee per user, so prices become scalable and adjustable if users are added or removed at any point. Proponents claim that SaaS gives a business the potential to reduce IT operational costs by outsourcing hardware and software maintenance and support to the cloud

provider. This enables the business to reallocate IT operations costs away from hardware/software spending and from personnel expenses, towards meeting other goals. In addition, with applications hosted centrally, updates can be released without the need for users to install new software. One drawback of SaaS comes with storing the users' data on the cloud provider's server. As a result, there could be unauthorized access to the data.SaaS Service providers: Salesforce and Google Applications

2. ADVANTAGES OF CLOUD COMPUTING OVER OTHER APPLICATIONS

2.1. EFFICIENCY / COST REDUCTION

By using cloud infrastructure, you don't have to spend huge amounts of money on purchasing and maintaining equipment. This drastically reduces capex costs. You don't have to invest in hardware, facilities, utilities, or building out a large data center to grow your business. You do not even need large IT teams to handle your cloud data center operations, as you can enjoy the expertise of your cloud provider's staff. Cloud also reduces costs related to downtime. Since downtime is rare in cloud systems, this means you don't have to spend time and money on fixing potential issues related to downtime.

2.2. DATA SECURITY

One of the major concerns of every business, regardless of size and industry, is the security of its data. Data breaches and other cybercrimes can devastate a company's revenue, customer loyalty and brand positioning. Cloud offers many advanced security features that guarantee that data is securely stored and handled.

2.3. SCALABILITY

Different companies have different IT needs — a large enterprise of 1000+ employees won't have the same IT requirements as a start-up.Using cloud is a great solution because it enables enterprise to efficiently — and quickly — scale up/down their IT departments, according to business demands.

2.4. MOBILITY

Cloud computing allows mobile access to corporate data via smartphones and devices, which is a great way to ensure that no one is ever left out of the loop. Staff with busy schedules, or who live a long way away from the corporate office, can use this feature to keep instantly up-to-date with clients and coworkers.

2.5. DISASTER RECOVERY

Data loss is a major concern for all organizations, along with data security. Storing your data in the cloud guarantees that data is always available, even if your equipment like laptops or PCs, is damaged. Cloud-based services provide quick data

recovery for all kinds of emergency scenarios — from natural disasters to power outages.

2.6. CONTROL

Having control over sensitive data is vital to any company. You never know what can happen if a document gets into the wrong hands, even if it's just the hands of an untrained employee. Cloud enables you complete visibility and control over your data. You can easily decide which users have what level of access to what data. This gives you control, but it also streamlines work since staff will easily know what documents are assigned to them. It will also increase and ease collaboration. Since one version of the document can be worked on by different people, and there's no need to have copies of the same document in circulation.

2.7. COMPETITIVE EDGE

Not every company will migrate to the cloud, at least not yet. However, organizations which adopt cloud find that many benefits that cloud offers positively impacts their business. Cloud adoption increases every year, since companies realize that it offers them access to world-class enterprise technology. And, if you implement a cloud solution now, you'll be ahead of your competitors.

CONCLUSION

Each type of application has its own benefits and weaknesses and can be utilized best within its own niche. I believe that both desktop and web applications will continue to coexist for a long time still most of the requirements are moving towards cloud applications for its unique advantages since unlike desktop applications, cloud doesn't need software installation resource allocation and software updates issues are not a problems in cloud based applications. So every organization has to be equipped to incorporate cloud applications to exists in the market.

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