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Aims and Scope

Journal of Information Sciences and Applications has become very important with the ever-increasing demands of the software development to serve the millions of applications across various disciplines. For large software projects, innovative software development approaches are of vital importance. In order to gain higher software standard and efficiency, software process adaptation must be derived from social behavior, planning, strategy, intelligent computing, etc., based on various factors. International Journal of Software Engineering address the state of the art of all aspects of software engineering, highlighting the all tools and techniques for the software development process.

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Contents

Edge Detection & Feature Extraction: Recursive Ant Colony System Approach

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A B S T R A C T

Automatic detection of edges in image is a classical problem in computer vision and image processing. Image edge detection refers to the extraction of the edges in a digital image. It is a process whose aim is to identify points in an image where discontinuities or sharp changes in intensity occur. This process is crucial to understand the content of an image and has its applications in image analysis and machine vision. As a meta-heuristic algorithm, ant colony optimization (ACO) has the features of robust, parallel, positive feedback, which prove it to be a useful means for searching optimal results from the problem. Compared with other heuristic algorithms, ACO is a population-based approach which uses exploitation of positive feedback as well as greedy search. Because of its parallel and discrete features, ACO is more suitable for image processing problems, such as segmentation, feature extraction, image matching and texture classification. Here our aim is to design an algorithm for image edge extraction which can be tuned using different parameters for satisfying performance in the presence of noise.

Keywords: Recursive Ant Colony System, Edge detection, Partitioning,2-opt,ACS, Heuristic Search

INTRODUCTION

The purpose of detecting sharp changes in image intensity is to capture significant events and changes in the physical properties of the world. Under general assumptions about the image formation process, discontinuities in intensity usually correspond to discontinuities in depth, discontinuities in surface orientation, changes in material properties, and variations in scene illumination. A representation of an image in terms of its edges is compact because it uses a set of one-dimensional curves instead of a two dimensional pattern. Hence, edges have been used as main features in many computer vision algorithms. Conventional approaches to edge detection are computationally expensive because each set of operations is conducted for each pixel. In conventional approaches, the computation time quickly increases with the size of the image. An ACO-based approach has the potential of overcoming the limitations of conventional methods. Transforming the input data into the set of features is called feature extraction. If the features extracted are carefully chosen it is expected that the features set will extract the relevant information from the input data in order to perform the desired task using this reduced representation instead of the full size input. It involves simplifying the amount of resources required to describe a large set of data accurately. When performing analysis of complex data one of the major

problems stems from the number of variables involved. Analysis with a large number of variables generally requires a large amount of memory and computation power or a classification algorithm. Feature extraction is a general term for methods of constructing combinations of the variables to get around these problems while still describing the data with sufficient accuracy. This paper intends to develop an algorithm for edge detection and feature extraction method integrating ant colony system and it's Recursive version. Noisy edges can also be relevant edges, i.e, relevant information may contain in noisy edges. Our algorithm will try to find out such edges. The rest of this paper is organized as follows. Section II review of existing algorithms. Section III describes the Ant Colony System in detail. Section IV presents Recursive Ant Colony System, a new approach based on Ant Colony System. Finally, in Section V conclusion is reported.

REVIEW OF EXISTING ALGORITHM

A. An Ant Colony Optimization Algorithm for Image Edgem Detection[4]

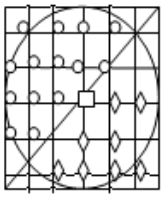
Gradient feature is simple but it is sensitive to noise and texture. Relative Difference of Statistical Means have strong ability to suppress noise but edge information may lose. Therefore authors have combined gray gradient value of pixel and relative difference of statistical means to image edge detection.

$$\Delta E_{\theta_n} = 0, E^1_{\theta_n} + E^2_{\theta_n} = 0$$

$$\frac{2\left|E^1_{\theta_n} - E^2_{\theta_n}\right|}{E^1_{\theta_n} + E^2_{\theta_n}}, E^1_{\theta_n} + E^2_{\theta_n} \neq 0$$

$\Delta E_{\theta n}$ is the relative difference of Statistical Means.

$$E^k_{\theta_n} = \frac{\sum_{x,y \in D} f(x,y)}{\underset{x,y \in D}{N}} k = 1,2; n = 0-3$$



$$\theta_n = n\Delta\theta$$

Probability Decision

$$\Delta\theta = \pi/4$$

$$p_{ij} = \frac{(\tau_{ij})^{\alpha}(\eta_{ij})^{\beta} w_{ij}(\Delta)}{\sum_{j \in \Omega}(\tau_{ij})^{\alpha}(\eta_{ij})^{\beta} w_{ij}(\Delta)}$$

Where i, j Ω indicates all the pixels that are in the 8-neighborhood of the pixel (i, j) . $\eta_{ij} = a\Delta E$

$$\Delta E = \max\{\Delta E_{\theta n}\}$$

w(Δ) is a weighting function, this function ensures that very sharp turns are much less likely than turns through smaller angles.

The feature of a pixel (i, j) is presented as below:

$$F_{ij} = a.\frac{\Delta I_{ij}}{\Delta I_{\max}} + b.\Delta E_{ij}$$

Where a and b are weighting factors. ΔImax denotes the maximum value of the gradient in image. Decision Process Finally, a binary decision is made at each pixel location to determine whether it is on the edge or not, by applying a threshold T on the final pheromone matrix.

B. Ant Colony Search for Edge Detection[5]

In this paper, a heuristic ant colony search algorithm is proposed to overcome the shortcoming of traditional edge extracting methods. Algorithm uses Sobel operator to get the possible edge points.

Heuristic measure is the key process used in this paper and given by following equation Heuristic information is related to the gradient and phase of the transition route.

f(i,j) -> gradient of node

θ(i,j) -> phase of node i,j

λ_1 , λ_2 -> constants where $\lambda_1 + \lambda_2 = 1$

$\Delta\Phi_{(i,j)}^{(r,s)}$ -> directional difference of ant move from node (r, s) to (i, j)

$$\eta_{(i,j)}^{(r,s)} = w(\Delta\varphi_{(i,j)}^{(r,s)})[\lambda_1 f_{(i,j)} + \lambda_2 \frac{1}{|\theta_{(i,j)} - \theta_{(r,s)}|}]$$

In each step of transition, the ant estimates whether the stopping criterion is satisfied. If satisfied, the search will stop on the current node; otherwise it will search the next transition node repeatedly until satisfying the criterion. The smaller of the pheromone and heuristic measure on the point, the higher probability of the search stopped at that point.

C. An ant-inspired algorithm for detection of image edge features[6]

The proposed model is based on the fact that an image is composed of a number of pixels, creating a map of cells. A neighborhood is defined for each pixel which identifies where the ants are permitted to move next. Pheromone is a decisive component in ant colony algorithms. Authors have defined two types of pheromone for the problem. Each ant lays a trail of pheromone type-I as it forages through the 2D map. Each ant is assigned a short term memory , which it uses to remember its last place that it visited also to follow a constraints, type-II pheromone is the component responsible for the decision making process of the ants.

D. Edge Detection Using Adaptive Thresholding and Ant Colony Optimiz- ation[18]

In the proposed approach, initially edges are extracted using adaptive thresholding. The connectivity of the edges so obtained is then increased using modified ACO. Adaptive thres holding typically takes a gray scale or color image as input and, outputs a binary image representing the edge information.

ANT COLONY SYSTEM[7]

AS was the first algorithm inspired by real ants behavior. AS was initially applied to the solution of the traveling salesman problem but was not able to compete against the state-of-the art algorithms in the field. On the other hand authors has the merit to introduce ACO algorithms and to show the potentiality of using artificial pheromone and artificial ants to drive the search of always better solutions for complex optimization problems. The next researches were motivated by two goals: the first was to improve the performance of the algorithm and the second was to investigate and better explain its behavior. Gambardella and Dorigo proposed in 1996 Ant Colony System (ACS) [8,9] .ACS differs from the previous AS because of following aspects:

A. Pheromone

In ACS only the best solution computed since the beginning of the computation is used to globally update the pheromone. As was the case in AS, global updating is intended to increase the attractiveness of promising route but ACS mechanism is more effective since it avoids long convergence time by directly concentrate the search in a neighborhood of the best tour found up to the current iteration of the algorithm. In ACS, the final evaporation phase is substituted by a local updating of the pheromone applied during the construction phase. Each time an ant moves from the current city to the next the pheromone associated to the edge is modified in the following way:

$$\tau_{ij}(t) = \rho . \tau_{ij}(t\text{-}1) + (1 - \rho)$$

$$\text{where } 0 \leq \rho \leq 1$$

is a parameter (usually set at 0.9) and t_0 is the initial pheromone value. t_0 is defined as $t_0=(n \cdot Lnn)^{-1,}$ where Lnn is the tour length produced by the execution of one ACS iteration without the pheromone component.

B. State Transition Rule

During the construction of a new solution the state transition rule is the phase where each ant decides which is the next state to move to. In ACS a new state transition rule called pseudo-random-proportional is introduced. The pseudorandom-proportional rule is a compromise between the pseudo-random state choice rule and the random-proportional action choice rule typically used in Ant System. The ACS pseudo-random-proportional state transition rule provides a direct way to balance between exploration of new states and exploitation of a priori and accumulated knowledge. The best state is chosen with probability q_0 (that is a parameter $0 \leq q\, q_0 \leq q_1$ usually fixed to 0.9) and with probability (1- q0) the next state is chosen randomly with a probability distribution based on η_{ij} and τ_{ij}. An ant positioned on node r chooses the city s to move to by applying the following rule,

$$s = \{\text{argmax}_{u \in J_k(r)} \{[\tau(i,j)][\eta(i,j)]^{\beta}$$

if $q \leq q_0$

S otherwise }-----(1)

where, τ(i,j) stands for pheromone on the edge (i,j), η(i,j) = 1/δ(i,j) is the desirability of edge(r,u), β is a parameter which determines the relative importance of pheromone versus distance, q is a value chosen randomly with uniform probability in [0,1], and q_0 (0<=q_0<=1) is a parameter that decides the probability to make random choices or to exploit the edges with higher pheromones, and S is a random variable selected according to the random proportional rule given below:

$$P_k(i,j) = \begin{cases} \dfrac{\tau(i,j).\eta(i,j)^{\beta}}{\sum_{u \in J_k(r)} \tau(i,j).\eta(i,j)^{\beta}} \end{cases}$$

Otherwise----------(2)

C. General ACS algorithm

1. Initialize pheromone trails and place M ants on the nodes of AS graph
2. Repeat until system convergence

2.1 For i = 1 to n

2.1.1 For j = 1 to M

2.1.1.1 Choose the node s to move to, according to the transition probability specified in (1).

2.1.1.2 Move the ant-k to the node s

2.2 Update the pheromone using the pheromone update formula (3) Ants change pheromone level of edges by applying local updating rule as described in equation (3).

$$\tau(i,j) \leftarrow (1-\rho) . \tau(i.j,) + \rho. \tau_0 \text{ ----------(3)}$$

where, 0<ρ<1 is the coefficient representing pheromone evaporation, and n is the number of cities and τ0 = (n*Lnn)-1, where Lnn is the tour length produced by nearest neighbor heuristic [13]. After all ants complete their cyclic tour, only the globally best ant (i.e. ant belonging to shortest tour) changes trail following global updating rule as given in equation (4).

$$\tau(i,j) \leftarrow (1- \alpha).\tau(i,j)+\alpha.\Delta\tau(i,j) \text{ -------(4)}$$

where, 0<α<1 is pheromone decay parameter, Lgb is the length of globally best tour, and Δ τ(i,j) = (Lgb)-1 , if (i,j) global best tour 0 , otherwise ----------(5)

Global updating rule is similar to a reinforcement learning process as in this case better solutions get higher reinforcement, thus providing high amount of trail to shorter tours.

RECURSIVE ANT COLONY SYSTEM[10]

Authors proposed a recursive ant colony system for Traveling salesman problem. The Recursive Ant Colony System (RACS) algorithm applies a partitioning scheme to the problem in a manner analogous to the recursive merge sort based on the divide and conquer technique. The algorithm is based on the fact that the efficiency of Ant Colony applications is better for problems of smaller size having less number of cities. This occurs due to the random nature of the algorithm, in which a large number of good random decisions made on weighed choices are required to come together to construct an efficient solution and as the size of the problem increases, so do the number of decisions to be made to generate a single tour. The RACS algorithm partitions the set of all nodes for a problem; say S, into two disjoint sets, say S1 and S2, and then proceeds to find solutions independently for the two sub-problems now created by focusing on reducing the lengths of the segments formed by these sets in the original tour, keeping the end points of any new path same as that in the original path. As the search space for these sub-problems gets reduced, resulting from the division of the nodes for the original problem, the exploration efficiency and hence the accuracy of the ACS algorithm is much greater for these sub-problems. The accuracy of the overall solution obtained by the conjunction of the solutions obtained from these sub-problems is upper-bounded by the accuracy of the division of the nodes for each subset, which in turn depends upon the accuracy of the initial candidate tour generated. Thus, the RACS algorithm employs a strategy of generating a candidate tour initially using an iterative ACS procedure, followed by partitioning of the tour and recursive implementation of the ACS and Greedy 2-opt(for symmetric TSPs) algorithms on the sub-problems created at each recursive level, to further improve the candidate solution initially generated. The recursive implementation can speed up the convergence for a large problem before its stagnation by focusing upon a targeted set of vertices separately and finding convergent paths for these smaller sub problems for which convergence can be obtained rapidly. Thus, the RACS algorithm is advantageous for larger problems where a convergent path is not easily found in limited time by using solely the Ant Colony algorithms. It can also avoid stagnation behavior by breaking down the problem and exploring alternate routes for each sub-problem. For the initialization purpose, authors have incorporated a nearest neighbor strategy into the ACS in the initial stages of the algorithm, also used a Greedy 2-opt edge exchange [16] heuristic for local optimization, implemented as discussed by Nilsson [17], for symmetric TSPs as its time complexity is $O(n^2)$ and it does not affect the overall time complexity of the algorithm. The algorithmic steps for Recursive ant colony system are as follows:

1) Initialization of parameters

2) Getting an initial optimal tour

3) Run normal Ant Colony

4) Partitioning

5) Recursive implementation

CONCLUSION

Many algorithms have been proposed by researchers based on Ant Colony Optimization algorithm for edge detection problem. A new approach Recursive ant colony system has been proposed. Therefore, for implementation, we will use recursive ant colony for edge detection and a new algorithm for edge detection using recursive ant colony system will be developed. Noisy edges can also be relevant edges, i.e, relevant information may contain in noisy edges. Our algorithm will try to find out such edges.

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Indexing Method for Semantic Information Extraction from the Medical Ontology

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ABSTRACT

Semantic information extraction is kind of retrieval process to extract the user required information from the medical ontology. Once the domain ontology is constructed from the web documents, the ontology mining technique can be used to extract the information using the interesting measures. Accordingly, an indexing method is developed for semantic information extraction from the medical ontology. The medical ontology contains different attributes and relations in an organized way. The proposed approach of semantic information extraction contains three important steps such as, query parsing, indexing and matching. The input query obtained from the user is parsed and the indexing is done by matching to the predefined profiles. Then, direct matching of query with attributes of ontology is done using similarity measures. The performance of the proposed medical information retrieval is evaluated under different evaluation criteria. From the results, it ensures that the proposed indexing method provides improved effectiveness without compromising the computational time.

Keywords:- Information extraction, indexing, ontology, query, semantic data.

1. INTRODUCTION

In recent decades, the amount of Web information growth has further exacerbated user needs for efficient mechanisms like information and knowledge location, selection, and retrieval. How to gather useful information from the Web becomes a challenging issue for all the Web users. Capturing user's information through a given query is extremely difficult in most Web information gathering as users provide only short phrases in queries to express their information needs. Also, because of different personal perspectives, expertise, and vocabularies web users express their queries differently. These differences cause the difficulties in capturing user information needs. Thus, for capturing user information needs user's personal interests and preferences must be understood. For this, ontology can be created in personalized Web information gathering. Ontology represent the concept model consisting of relevant and non- relevant concepts which is obtained from their background knowledge. If concept models can be specified the user's interest, user information needs can be better captured, and therefore, meaningful, and personalized information can be gathered for Web users [6-10].

To simulate user concept models for gathering web information [2-5], ontologies are used. If ontologies can specify user background knowledge then more accurate user profiles can be acquired and thus the

user information needs can be captured effectively [8]. Accordingly, an indexing method is developed for semantic information extraction from the medical ontology. Once the ontology is constructed, the relevant information can be retrieved based on the user query. Here, the retrieval algorithm is developed to obtain the most suitable information from the ontology. Here, two different types of information can be retrieved from the ontology, the disease information by putting the symptoms as query and drug information by putting the disease as query. The most supported information is extracted from the ontology and supplied to the user. The rest of the paper is organized as, the 2nd section contains existing works. The detailed proposed approach is written on the 3th section and results are produced in the 4th section. The 5th section consists of the conclusion part of the proposed approach.

2. EXISTING WORKS

A handful of recent works are available in the literature for information extraction from the domain ontology. Accordingly, Chin-Ang Wu et al. [1] have proposed an active multidimensional association mining framework that incorporates with user preference ontology, which contains surrogate queries that represent frequently, used queries in the query history log. The representative power and the user preference of the surrogate queries are derived and expressed in fuzzy linguistic terms. The construction of the ontology is demonstrated also for mining search results. In this work, an indexing method is developed for medical information search using ontology. Here, two different types of information can be retrieved from the ontology, the disease information by putting the symptoms as query and drug information by putting the disease as query. For these two types of information retrieval, an algorithm is developed to obtain the information in an easy way. The proposed algorithm can be able to find the important information from the ontology, helping to the users to find some useful information about the disease and the drugs without much consulting with the doctors.

3. INDEXING METHOD FOR SEMANTIC INFORMATION EXTRACTION FROM THE MEDICAL ONTOLOGY

This section presents the indexing method for semantic information extraction from the medical ontology. Initially, medical ontology is constructed from the document based on the user's requirement using attributes selection and relation finding. The medical ontology developed is then given to this algorithm for extracting information. The proposed method of extracting the information from the user is done with three important steps such as, i) Obtaining user query, ii) query indexing, iii) Query searching.

3.1. Obtaining user query

The major step as considered by the proposed approach is the extraction of the information from the constructed ontology. The information from the ontology is extracted based on a particular query

assigned by the user. There are some important measures in accepting the queries. The proposed approach is using an indexing based approach for the retrieval of information from the ontology. The proposed approach gives the option to the user, the choice of entering either disease as the query or the symptoms. The indexing done based on the query given and is accounted to the proposed method as a set, i.e. the proposed method accepts the input as a set of two values, which can be represented as,

$$query \rightarrow < d : I; S : I > \quad (1)$$

3.2. Query indexing

The query is accepted with their text given and the program automatically creates an index for the query with index 'I'. The index value is selected as 1 and 2, when diseases is entered as the query, then 1 is set as the index, while symptoms is given, the index I is set as 2. The query indexing is given to speed up processes of the ontology taxonomy traversal. If the query is given without the index value, the query word has to be compared with all the nodes in the ontology, which reduce the efficiency of the method because of the unwanted searches. So as to handle such condition the index values will be helpful. The index values act as identifier to the query and the nodes in the ontology and also help in matching the correct attribute to the relevant query. In the similar way, the ontology also indexed as per the indexing technique. We have used a forward indexing technique here.

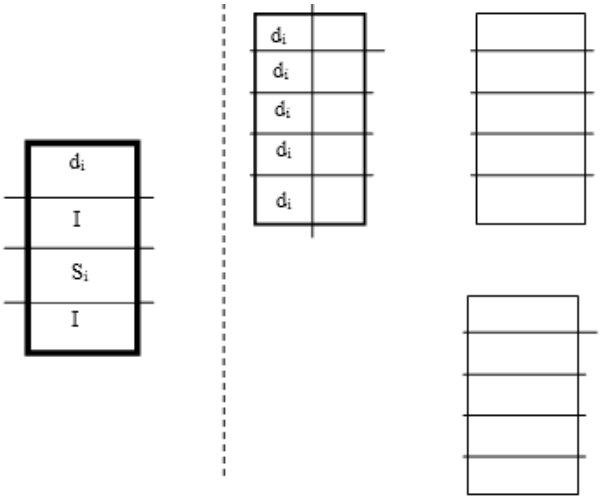

Figure 1. Indexing query and attributes

3.3. Query searching

Once the indexing is finished for the attributes, the information extraction has to be subjected based on the query. The query search for the relevant data regarding the index defined on the query. The search will continue upto the relevant information is extracted. The query initially identifies the relevant attribute, by comparing the index value of the top nodes of the disease set and the symptoms set. If the indexes are matched, then relevant attributes search for the associated attribute and that attribute will point towards the drug associated with disease. The process can be illustrated as follows.

on index values and ontology also associated with index values. The time is the effective factor regarding the performance evaluation of the proposed approach. The time evaluation is taken by considering the time, which is required for the extracting information from the ontology based on the query. A number of queries are subjected to evaluate the performance of the proposed approach.

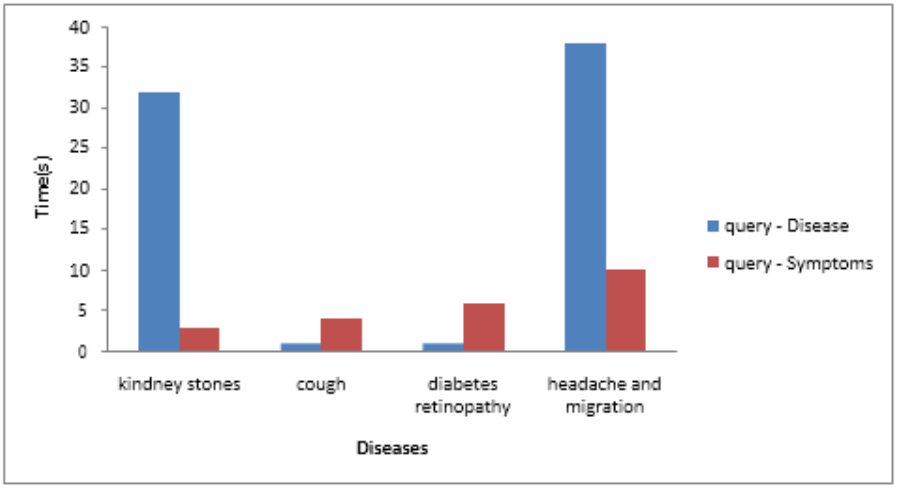

Figure 3. Performance evaluation

The figure 3 shows the performance evaluation of the proposed approach based on the time for information extraction. The process is done based on two different ways, by comparing the query with the disease and by comparing the query with the symptoms. We have considered four different diseases for the information extraction. When considering the responses marked in the graph, it can be identified that the query disease comparison shows both peak time and less time.On the other hand the query – symptom shows constant time deviations. Thus, the information can be evaluated quickly by giving the query symptoms comparison strategy.

5. CONCLUSION

In this work, an indexing method is presented for semantic information extraction from the medical ontology. The medical ontology contains different attributes and relations in an organized way. The extraction of information from the medical ontology is done using three important steps such as, obtaining query, indexing and query matching. The input query obtained from the user is parsed and the indexing is done by matching to the predefined profiles. Then, direct matching of query with attributes of ontology is done using similarity measures. The experimentation is carried out on database extracted from the internet and the performance evaluation is conducted. The performance evaluation showed that the proposed approach is a time effective one. The maximum time required for query – diseases approach is high as compared with the query – symptoms approach.

The figure 1 explains the extraction information from the attributes based on the given user query. Initially the indexed query is selected and according to the index value, the relevant attribute is selected, either diseases or attributes. The selected attribute will search for the associated attribute. If disease is selected, then it will go for finding the associated symptoms and vice versa. Then, the proposed method triggers the search for the drug associated with attribute in selection. Once the drug is identified the relevant information regarding the query is retrieved as a tuple containing three values.

$$< d_i ; s_i ; r_i > \quad (2)$$

Where, the di represents the diseases, ri represents the drug and the si represents the symptoms of the disease. The information is extracted based on the similarity score between each associated attributes. A set of information can be extracted from the attributes based on a query, but the information, which possess high similarity score is selected as the most relevant information regarding the input query. The query retrieval algorithm developed in this work is given in figure 2.

Input : User query
Output : Extracted information
Procedure:

Start

Select the input query
Index the query

$$query \rightarrow < d : I ; S : I >$$

Compare query with attribute

$$q : I \Leftrightarrow < d_i : I ; s_i : I >$$

$$if (q : I \approx d_i : I)$$

$$then\ SELECT\ (d_i)$$

$$find\ associateds_i$$

Find the drug associated with d_i and s_i.

Extract the set of information regarding query

Select the extracted information with high mutual information score

End

Figure 2. Query retrieval algorithm

The performance of the proposed medical information retrieval is evaluated under different evaluation criteria. The dataset includes the data including different diseases, symptoms and drugs. The data are extracted from the from the internet database, over 100 document areextracted based on the medical data. The data are processed to extract the relevant details such as diseases, symptoms and drugs, in order to conduct research.

Time(s)The performance evaluation of the proposed approach is conducted based on the time required for the extraction of information from the ontology as per the query given by the user. The query is based

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Impact of Reward Prioritization at Various Life Stages on Psychological Well-Being in E- Commerce Sector

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ABSTRACT

Objective: *Reward prioritization is becoming extremely crucial in today's age. Organizations are taking reward prioritization and psychological well being as a means of success for the organization as well as for the individual. We tested to what extent the reward prioritization at different life stages of the employee enhances the psychological well being .*

Methods: *The 180 employees in were interviewed with the help of questionnaires in six different categories.*

Results: *The appropriate reward prioritization at different life stages plays a very imperative role in the psychological well being of the employee.*

Conclusion: *This paper provides preface indication that the appropriate reward prioritization at different life stages of the employee enhance the psychological well being which facilitates the employees to perform better, builds up the confidence, develops the talent, help in teamwork, increases employee commitment, high morale, productivity, efficiency, quality of service and also handles personal life well*

.Implication: *The apposite reward prioritization at different life stages of the employee have significant impact the psychological well being and it assist in achieving the business objectives of the company. Originality/value: The paper reports that correct reward prioritization at different life stages are the only way to enhance psychological well being.*

Key words: Reward Prioritization, Psychological well being, E- commerce

INTRODUCTION

The reward is the monetary and non-monetary return provided to employees in exchange for their time, talents, efforts and results. It involves the deliberate integration of five key elements that effectively attract, motivate and retain the talent required to achieve desired business results. The five key rewards elements are: Compensation Benefits Work-life Performance and Recognition Development and Career Opportunities. The Psychological Well-being is a dynamic concept that includes subjective, social, and psychological dimensions as well as health-related behaviors. Psychological wellbeing facets include the following: self-acceptance, the establishment of quality ties to other, a sense of autonomy in thought and action, the ability to manage complex environments to suit personal needs and value, the pursuit of meaningful goals and a sense of purpose in life and continued growth and development as a person Psychological well-being is usually conceptualized as some combination of positive affective states such as happiness (the hedonic perspective) and functioning with optimal effectiveness in individual and social life (the eudemonic perspective) .Examples of intrinsic rewards are feelings of achievement and personal growth, while extrinsic rewards include outcomes such as salary, status, job security and fringe benefits .

LITERATURE REVIEW

Chen and Hsieh (2006) indicated that the traditional seniority-based trend has been changed in to performance-based, monetary trend into non monetary, extrinsic function in to intrinsic, periodic reward in to instantaneous, unitary rewards in to differential and independent in to coordinated. coin the word “new pay” and link it to organizational and employee performance. They characterized the concept of new reward by various traits like its strategy, flexibility, performance orientation, integration and distinctiveness with regard of the action of employee and employer.

Reilly (2003) advocates that unitary view point reflects that the idea of “new reward” is very much there in HR mainstream and focal point is to shape the mind-set and behavior at work stressing upon the integration, elasticity and performance. However philosophical groundwork to new reward is not supporting because “new pay” is not the combination of compensation practices rather its contemplation about the function of reward in a multifaceted organization.

Zingheim and Schuster (2000) comment that the conception of “total rewards” can be categorized in to four components: convincing future, encouraging workplace, individual growth and “total pay”. Explained the total pay as the combination of basic salary, performance- based salary, benefits, and acknowledgment or feedback. Employees are in awe of the “total pay” that is devised around their taskand needs. Several alternatives available are basic salary to reward the workers continuing value; performance based salary to highlighting the results; benefits to give safety from life and health vulnerabilities, in addition to vacation, identification and feed back. Consequently the companies that address individual's need and preferences adequately in terms of total pay more likely to “attract” and “retain” key workers and by applying such methods organization anticipates enormous concentration to non- monetary aspects of rewards.

Preeti and Rawat(2011) found the relationship between psychological empowerment and organization commitment and stated that empowerment is granting power or enabling people to exercise power, Organizational commitment is understood as individual's identification with and involvement in the organization.

Frederick Herzberg(1989) paid attention on improving employee performance through various psychological approaches to human relations and tried to redress industrial social scientists over concern about how to treat workers to the neglect of how to design the work itself.

The sample under study was fragmented under following categories-

- Men- Unmarried
- Men- Married with no children
- Men- Married with children
- Women- Unmarried
- Women- Married with no children
- Women- Married with children

180 respondents comprising of 30 respondents of each category were the sample population under the research study. The respondents belonged to the IT/ITes industry and were reached majorly through social networking websites such as Linkedin, gmail, Facebook.

Instruments Used

1. Ryff's Psychological Well-Being Scales (PWB), 42 Item version
2. Reward Prioritization Questionnaire.

Data was collected through two structured questionnaires one of which was a standardized questionnaire named Ryff's Psychological Well-Being Scales (PWB), 42 Item version which has reliability of 0.76 and the other one was a self made structured questionnaire on reward prioritization which had 16 questions on 5 parameters namely Work-life, Benefits, Development and career opportunities, compensation and Performance & Recognition. This questionnaire had a reliability of 0.72. Both the questionnaires were designed using 5-point Likert scale with (1=”strongly agree”, 2=”agree”, 3=”neutral”, 4=”disagree”, 5=”strongly disagree.

Data Collection

The data was collected through questionnaires from the targeted sample. Then, the data was categorized as per the above mentioned 6 categories. Data was then analyzed to gather that how different categories prioritize various elements of total rewards. This was done through calculating average of responses of each category of respondents and then calculating mean of the different elements separately. The elements were then numbered accordingly as per the results for each category. Thus, the first objective of the study of reward prioritization at various stages of employee life cycle was met through the results. Then, average mean score of the data collected through psychological well-being questionnaire was

•Women- Married with no children Table 1.6

Work-Life	1
Benefits	4
Development & career opportunities	5
Compensation	2
Performance & recognition	3

•Women- Married with children Table 1.7

Work-Life	1
Benefits	2
Development & career opportunities	5
Compensation	3
Performance & recognition	4

•Men- Unmarried

Descriptive Statistics

	Mean	Std. Deviation	N
Reward prioritization	1.3333	0.47946	30
p1234	2.8494	0.20825	30

Correlations

		reward prioritization	p1234
reward prioritization	Pearson Correlation	1	.85**
	Sig. (2-tailed)		0.3
	N	30	30
p1234	Pearson Correlation	.85**	1
	Sig. (2-tailed)	0.3	
	N	30	30

The results reveal that development and career opportunities is positively correlated with psychological well- being of an individual with a value of 0.85 which signifies that deviation in both moves in the same direction i.e as per the results if the respondents under this category get optimum development and career opportunities that they aspire for in their organization, then they would be autonomous, they will have positive relations, they would have a purpose in life, their self- acceptance would be high and they will always look forward towards their personal growth and vice- versa.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.871[a]	0.761	0.762	0.32961
a. Predictors: (Constant), reward prioritization				

calculated which thus represented the whole sample. Then, correlation was calculated between the highest priority element of the total rewards and psychological well- being mean score for each category which depicted that the two are positively correlated or negatively correlated.

DATA ANALYSIS AND FINDINGS

Reliability analysis is done to check the reliability of the self-structured questionnaire on reward prioritization. The reliability is .72 which states that the questionnaire is highly reliable.

Reliability Statistics	
Table 1.1	
Cronbach's Alpha	N of Items
0.72	17

Following are the mean scores depicted against each element of total rewards category-wise for each of the 6 categories-

•Men- Unmarried Table 1.2

Work-Life	2
Benefits	4
Development & career	1
opportunities	
Compensation	3
Performance &	5
recognition	

•Men- Married with no children Table 1.3

Work-Life	5
Benefits	3
Development & career opportunities	4
Compensation	1
Performance & recognition	2

•Men- Married with children Table 1.4

Work-Life	3
Benefits	1.5
Development & career opportunities	5
Compensation	4
Performance &	1.5
recognition	

•Women- Unmarried Table 1.5

Work-Life	3
Benefits	4
Development & career opportunities	1
Compensation	5
Performance & recognition	2

Coefficients [a]						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.157	0.098		32.089	0
	reward prioritization	-0.231	0.07	-0.871	-3.314	0.3

The results reveal that reward prioritization has high impact (0.76) on psychological well being of the respondents under this category. Thus, if the individuals don't get expected career opportunities from their employers, then it might affect their well being and they will be dissatisfied with their lives and 0.30 level of significance denotes that only 30% of psychological well being of an individual is explained by the independent variable (i.e development & career opportunities).

•Men- Married with no children

Descriptive Statistics

	Mean	Std. Deviation	N
reward prioritization	1.3333	0.47946	30
p1234	2.8902	0.20785	30

Correlations

		Reward prioritization	p1234
Reward prioritization	Pearson Correlation	1	.92**
	Sig. (2-tailed)		0.39
	N	30	30
p1234	Pearson Correlation	.92**	1
	Sig. (2-tailed)	0.39	30
	N	30	

The results reveal that compensation is positively correlated with psychological well- being of an individual with a value of 0.92 which signifies that deviation in both moves in the same direction.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.910[a]	0.83	0.83	0.17961
a. Predictors: (Constant), reward prioritization				

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.157	0.098		32.089	0
	Reward prioritization	-0.231	0.07	-0.91	-3.314	0.39

The results reveal comparatively low impact on psychological well-being due to insufficient benefits, low performance and no recognition and it was found that 24% of psychological well-being is explained by independent variable i.e benefits, performance & recognition.

•Women- Unmarried

Descriptive Statistics

	Mean	Std. Deviation	N
reward prioritization	1.3333	0.47946	30
p1234	2.9994	0.21925	30

Correlations

		reward prioritization	p1234
reward prioritization	Pearson Correlation	1	.91**
	Sig. (2-tailed)		0.37
	N	30	30
p1234	Pearson Correlation	.91**	1
	Sig. (2-tailed)	0.37	30
	N	30	

The results reveal that development and career opportunities is positively correlated with psychological well- being of an individual with a value of 0.91 which signifies that deviation in both moves in the same direction.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.90[a]	0.81	0.81	0.17961
a. Predictors: (Constant), reward prioritization				

Coefficients [a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	3.157	0.098		32.089	0
	Reward prioritization			-0.901		
		-0.231	0.07		-3.314	0.37

The results reveal that there is high impact of development and career opportunities on psychological well-being in this category of unmarried women and significant 37% of psychological well-being of women under this category is explained by development & career opportunities.

The results reveal very high impact on the psychological well being of the respondents under this category and it can be said that amongst all three categories of men defined in this research, this category is affected most by the absence of expected compensation package to a extent of 0.83 and thus people suffering under this category will have highest effect on their psychological well-being. In addition, it canbe said that 39% of the effect on psychological well-being is explained by the independent variable i.e compensation.

•Men- Married with children

Descriptive Statistics

	Mean	Std. Deviation	N
reward prioritization	1.3333	0.47946	30
p1234	2.8004	0.25575	30

Correlations

		reward prioritization	p1234
Reward prioritization	Pearson Correlation	1	.70**
	Sig. (2-tailed)		0.24
	N	30	30
p1234	Pearson Correlation	.70**	1
	Sig. (2-tailed)	0.24	30
	N	30	

The results reveal that (performance & recognition) & benefits is positively correlated with psychological well- being of an individual with a value of 0.70 which signifies that deviation in both moves in the same direction.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.796[a]	0.634	0.636	0.17961
a. Predictors: (Constant), reward prioritization				

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.157	0.098		32.089	0
	reward prioritization	-0.231	0.07	-0.796	-3.314	0.24

Descriptive Statistics

	Mean	Std. Deviation	N
reward prioritization	1.3333	0.47946	30
p1234	2.8984	0.28765	30

Correlations			
		reward prioritization	p1234
reward prioritization	Pearson Correlation	1	.62**
	Sig. (2-tailed)		0.14
	N	30	30
p1234	Pearson Correlation	.62**	1
	Sig. (2-tailed)	0.14	30
	N	30	

The results reveal that work-life is positively correlated with psychological well- being of an individual with a value of 0.62 which signifies that deviation in both moves in the same direction. This category is least correlated with psychological well-being and thus it is inferred that though this category is positively correlated with psychological well-being but amongst all the others it is the least correlated which means that absence of work life balance would have significant lesser impact on psychological well being of those employees which fall into this category.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.730[a]	0.533	0.73	0.17961
a. Predictors: (Constant), reward prioritization				

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.157	0.098		32.089	0
	Reward prioritization			-0.73		
		-0.23	0.07		-3.314	0.14

The results reveal that there is very low impact of work life on psychological well-being in this category of married women with no children in comparison with the other categories and significant 14% of psychological well-being of women under this category is found to be explained by work life which is the independent variable in this case.

Women- Married with children

Descriptive Statistics			
	Mean	**Std. Deviation**	**N**
reward prioritization	1.3333	0.47946	30
p1234	2.7654	0.21925	30

Correlations			
		reward prioritization	**p1234**
reward prioritization	Pearson Correlation	1	.87**
	Sig. (2-tailed)		0.033
	N	30	30
p1234	Pearson Correlation	.87**	1
	Sig. (2-tailed)	0.033	30
	N	30	

The results reveal that work-life is positively correlated with psychological well- being of an individual with a value of 0.62 which signifies that deviation in both moves in the same direction i.e as per the results if the respondents under this category are able to maintain proper work- life balance that they aspire for in their organization, then they would be autonomous, they will have positive relations, they would have a purpose in life, their self- acceptance would be high and they will always look forward towards their personal growth.

Model Summary

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.892[a]	0.796	0.8	0.17961
a. Predictors: (Constant), reward prioritization				

Coefficients[a]

Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	**Std. Error**	**Beta**		
1	(Constant)	3.157	0.098		32.089	0
	Reward prioritization	-0.231	0.07	-0.892	-3.314	0.033

The results reveal that there is high impact of work life on psychological well-being in this category of married women with no children in comparison with the other categories and significant 33% of psychological well-being of women under this category is found to be explained by work life which is the independent variable in this case. It can be noted that the two variables (i.e women married without children and women married with children) were the independent variables acting on the same dependent variable i.e psychological well-being, but the forth explained only 14% of the dependent variable w zhile 33% was explained by the latter.

Findings

1. If unmarried men get expected development and career opportunities, and then they would be autonomous, they will have positive attitude towards life, their self-acceptance would be high and they would look forward towards their personal growth which shows that he will be self motivated towards his goals.
2. If married men with no children don't get compensation up to their expectations then there is a high possibility that they may have feelings such as unhappiness, incapability and will be unsatisfied with life. They won't be able to manage complex environment and will have negligible sense of purpose of life which would affect their personal life as well.
3. In the category of married men with children, low impact on psychological well-being is found due to insufficient benefits, low performance and no recognition. The reason behind it could be that they are already well settled in their life and they give equal importance to their personal life as well. Hence, their major focus is not only on their professional life and they might majorly focus on their mental peace.
4. In case of unmarried men and unmarried women, similar variations have been found on psychological well-being due to development & career opportunities.
5. Absence of work life balance would have significant lesser impact on psychological well being of those women who are married with no children and more impact has been found on those who have children may be because they have to give importance to their children as well.
6. The two variables (i.e women married without children and women married with children) were the independent variables acting on the same dependent variable i.e psychological well-being, but the forth explained only 14% of the dependent variable while 33% was explained by the latter.

1. CONCLUSION

It can be concluded that employees in their various life stages give importance to different kinds of rewards that they are awarded for by the employers in return if their services for the organization. The availability and unavailability of these rewards impacts their psychological well-being (self acceptance,establishment of quality ties with others, sense of autonomy in their thought and action, ability to manage complex environment, pursuit of meaningful goals and sense of purpose in life and continued growth and development as a person) to a large extent in majorly all life stages for both men and women. Least impact has been found on those women employees who have no children and most has been found on those men who are married and have no children. There can be numerous reasons behind the results and their can be other significant environmental variables into play as well.

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Resolving Communication Concerns and Exploring the Emergence of Social Networks in Collaborative Software Development

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ABSTRACT

Collaborative software development is very important as the developers in a team might be located in various geographical areas. There are groupware products that accommodate the needs of the developers who collaborate. Formal and technical communication among the team members is crucial for the success of the endeavor in this regard. Towards this end Treude and Storey explored work item tagging in which they consider a scenario where multipleparties or developers can involve in technical communication. Tagging a work item and updating it as the work progresses can provide useful knowledge to team members so that they can avoid lengthy technical discussions. Here Developa prototype application is designed and built in order to facilitate multiple users of the development team who collaborate from different geographical regions. The users involved include tag authors, work item authors and work item owners.Technical communication among the three users is provided by the prototype besides allowingthem to have informal communication. The experimental result reveals that the prototype is useful to support communications among the members of collaborative software development team.

INTRODUCTION

Software development has gone through many phases over a period of time. From the initial "trial and error" kind of development, it went to the software process models that can help in systematic software development. The latest development is that the team members need not be located in particular geographical area. It is possible to have collaborative software development that helps team members to work a software product without time and geographical restrictions. With these provisions in place, humans can solve very complex problems as well [1]. Computer Aided Software Engineering (CASE) is the discipline that helps developers to utilize the computerized software development which increases the productivity. With the help of CASE tools available, it is possible to achieve smooth communication across the stakeholders of a project. Though individuals are involved in software development, an individual is not doing it alone. It is the combined effort of many users and now it is also possible for a team of members to collaborate from various geographical locations across the globe.

The tools that are existed for collaborative software development include Jazz [2] and INCOME/START [2]. The former is from IBM. These tools help the communication process of the team

members. However, these tools do not have any communication procedures with respect to social aspects [4]. Thus there is possible necessity for such tools to have communication provisions for social networking as well among the software team members. The formal and informal communications can help to built relationships among the team members besides solving problem in technical communication. The Jazz tool is used to have light weight communication in the form of tagging. Tagging work items help in communication scenarios of projects being done in collaborative fashion. In [5] the Jazz tool was explored in collaborative environment. Here built a prototype application with web interface that helps people from many geographical locations to have collaborative effort in technical communications of software development. A prototype application is built in order to facilitate multiple users of the development team who collaborate from different geographical regions. The users involved include tag authors, work item authors and work item owners. Technical communication among the three users is provided by the prototype besides allowing them to have informal communication.

The rest of this paper is designed as charts. Section 2 analyses related works. Section 3 focuses on Jazz tool as described in [5]. Section 4 provides information about the proposed design and implementation of web based prototype. Section 5 presents the experimental results while the section 6 concludes this paper.

RELATED WORKS

This section reviews literature on prior works pertaining to collaborative computing and work item tagging. Human beings saw the software development as a challenging task for many years [1]. Traditionally the software development is carried out by group of people forming a team. As part of software engineering there are many process models came into existence. As the task of software development is not simply writing some programs, a systematic approach and systematic communication process is required in the development process [6]. There are necessary mechanisms to bring about coordination among the members of a team [7]. There are many challenges and cultural issues involved in the team which is made up of people with diverse skills [8]. When colleagues are there in different countries, they might be facing difficulties to have collaborative access to software being developed [9]. In this case there should a tool to achieve this kind of communication among team members.

The success of projects in collaborative environment depends on the proper communication facilities provided by tools [10], [11]. Configuration management tools are also in place that help in providing communication and resolve communication conflicts as explored in [12]. The CASE tools such as Bugzilla can help developer to work faster and improve productivity in software development [13]. A

light weight social computing phenomenon such as tagging can be used with social dimension. Many software tools used tagging for supporting technical communication among the software development team members. With tagging in place, developers can have control technical communication that helps in collaborative computing scenarios [14]. Another technique is annotations [15] which can be used for additional and important communication in software development. Recent tool named Tag SEA [16] is used for tagging in collaborative software development environment. Other tools which are in use include concern Graphs [17] etc. Here build a tool that helps collaborative members to have formal and informal communications.

JAZZ Tool EI Case Studies

In this section two tools which are already existed are studied. They are Jazz and EI. They provided collaborative software development provisions and also resolve communication problems among the team members. The Jazz tool supports integration of various phases in the software development. Work items of various categories can be organized in it. Jazz has merit in having tool support for collaborative software development. On the other hand EI is another tool that also supports collaboration. It also helps the teams in using work item tagging.

Table 1 shows the data extracted from various sources.

Case	Data Object	Amount
Jazz	Work Item	65,268
	Tag Instance applied to work item	27,252
	Tag instance removed from work item	2,452
	Numbers of unique tag keywords	1,184

As shown in table 1, the data related to Jazz tool is taken from repositories. The count of work items, the work item tagging used for work items and the instances of tags, number of keywords used for tagging is shown in table 1.

Table 2 - frequency of tag instance of Jazz tool

Tag Keyword	# instances
Polish	966
Svt	870
Us	668
Tvt	636
Testing	565
Globalization	442
Usability	441
Maintainecanditate	436
Error handling	431
Must fix	421

As seen in table 2, the frequency of tag instances of Jazz tool is presented in descending order by the count of tag instances. Table 3 provides tag keywords that are most frequently shared in Jazz tool.

Table 3- Most Frequently Shared Tag Keywords in Jazz

Tag Keyword	#instances	#distinct users
Performance	413	46
Globalization	442	45
Tvt	636	45
Polish	966	43
Maintaincecanditate	436	40
No code	197	40
Error handling	431	38
Usability	441	38
Beta2candidate	308	35
Rc4candidate	133	33
Ux	688	33

As seen in table 3, it shows tag keywords, the number of instances and the number of users who used those tag instances.

Proposed System

The proposed system is modeled after the concepts provided in [5]. The aim of the proposed system is to support collaborative software development in terms of work item tagging which provides technical communication possible among various users of the system. The users includework item owner, work item author and tag author. Each user has specific role to play in the application. All users can have collaborative communication with little effort. There will be no lengthy discussions required as the tags can carry sufficient meaning that can be understood by the team members. The communication concerns are taken care of by the tool that helps smooth communication among the team members. The proposed tool is also compared with other tools such as Jazz. The proposed application also supports limited social networking among the team members to have informal communications. Thus the tool proposed can support both formal and informal communications among the team members. Figure 1 shows the schematic overview of the proposed application.

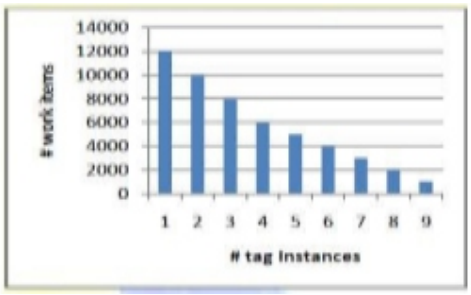
Fig. 1 – Schematic Overview of the Proposed System

As shown in Figure 1, it is evident that the application has many provisions. They include sharing of work, tagging the work items, collaborative communication and limited social networking for informal communications among the team members.

Experimental Results

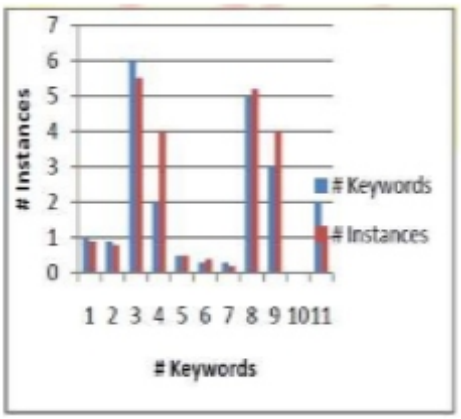
The environment used for the tool implementation includes a PC with 2GB of RAM and Core 2 Dual processor. JDK 1.7 and Tomcat 7.0 and Net Beans are used for the development of the tool. First of all Jazz and EI tools were studied before implementing the proposed application. The results of observations exist in fig. 2, 3 and 4.

Fig. 2 – Distribution of Tag Instances to Work Items with respect to Jazz



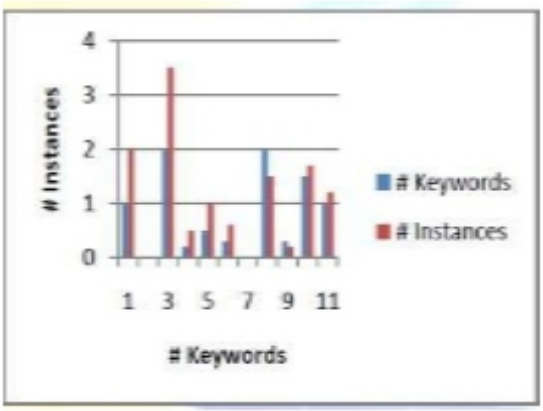
As can be seen in fig. 2, it is evident that the horizontal axis represents tag instances while the vertical axis represents number of work items. As the work items are increased the tag instances are also increased.

Fig. 3 – Number of instances and tag keywords (Jazz)



As Figure 3 shows there are number keywords and number of instances represented by horizontal and vertical axes. The tag keywords include tooling, unclassified, testing, planning, environment, documentation, cross cutting, collaboration, component, architecture etc.

Fig. 4 – Number of Instances and tag keywords (EI)



As Figure 4 shows there are number keywords and number of instances represented by horizontal and vertical axes. The tag keywords include tooling, unclassified, testing, planning, environment, documentation, cross cutting, collaboration, component, architecture etc.

CONCLUSION

This paper focuses on studying the need for collaborative software development and the tools available for the same. Here build a prototype application or a tool that can help a group of people to collaborate and have technical communication among them. The users who use this application include work item owners, work item authors and tag authors. The tagging concept helps them to have purely technical communication among them. The tagging eliminates the need for complex interactions unnecessarily. Moreover the tool also facilitates to have informal communication among the team members in order to have limited social networking capabilities. Thus the tool became important communication medium for both formal and information communications among the team members who participate in collaborative software development. The empirical results are encouraging.

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The WiMAX Generic PDU for Physical Layer Process

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ABSTRACT

The major trend that is already emerging is the migration of mobile network. The next generation of wireless systems, i.e. 4G systems will use new spectrum and emerging wireless air interfaces that will provide a very high bandwidth of 10+ Mbps. WiMAX is an advanced technology, it is optimized for high-speed data and should help spur innovation in services, content, and new mobile devices like, fixed and mobile applications based on an open standard designed to help deliver ubiquitous, high-throughput, broadband wireless services at a low cost flexible way. In this paper we deal with the physical layer of WiMAX system. This model is very useful to analyse the WiMAX system. The model presented in this paper built with generic MAC PDU processed by the Physical Layer using displayed time-scatter plots for 10, 20 and 30dB time-scatter plot for the output from the transmitter and the transmitted signal.

Keywords– Convolution Coding, OFDM, Physical Layer, WiMAX

I. INTRODUCTION.

The World wide interoperability for Microwave Access (WiMAX) Forum has begun certifying broadband wireless products for interoperability and compliance with a standard a broad industry consortium. WiMAX is based on wireless metropolitan area networking (WMAN) standards developed by the IEEE 802.16 group and adopted by both IEEE and the ETSI HIPERMAN group. In this paper, we present a concise of the emerging WiMAX solution for broadband wireless. The purpose here is to provide an executive summary, the salient features of WiMAX model with the physical and MAC-layer characteristics of WiMAX.

IEEE 802.16 Wireless MAN has a connection-oriented MAC and PHY is based on non- line of sight radio operation in 2-11 GHz. For licensed bands, channel bandwidth will belimited to the regulatory provisioned bandwidth divided by any power of 2, no less than 1.25MHz.

Three technologies have been defined like single carrier (SC), orthogonal frequency division multiplexing (OFDM) and orthogonal frequency division multiple access (OFDMA). We develop a model for WiMAX using convolution coding techniques for AMC PDU process in our major paper. If a model for a system is developed after the design phase and tested correctly then early detection of a problem with the We develop a model for WiMAX using convolution coding techniques for AMC PDU process in our major paper. If a model for a system is developed after the design phase and tested

correctly then early detection of a problem with the design is possible. This will reduce the time and cost to change the design at the later stages of the development. Once a model is built, tested and verified against a set criterion then using tools like Simulink and Matlab could be helpful in generating the code and exporting the model in suitable formats for implementation in hardware processors.

Models for other IEEE standards such as Bluetooth and Wireless LAN have been developed in the past using Matlab. There was a need to build a model for the WiMAX on similar lines to fill the gap.

II. THE WiMAX MODEL

The Model for the WiMAX is built from the standard documents. The model implemented in this paper is based on the WiMAX which has the following characteristics on the overall project development lifecycle .

Table-1 ***THE CHARACTERISTICS OF THE OVERALL WIMAX MODEL DEVELOPMENT LIFE CYCLE***

Standard	IEEE 802.16e
Carrier Frequency	Below 11 GHz
Frequency Band	2.5 GHz, 3.5 GHz, 5.7 GHz,
Radio Technology	OFDM and OFDMA
Bandwidth	1.5 MHz to 20 MHz
Data Rate	70 Mbps
Distance	10 km
GHz= gigahertz, OFDMA= Orthogonal Frequency Division Multiplexing Access, MHz= Mega Hertz, Mbps= Megabits per seconds, km=kilometer.	

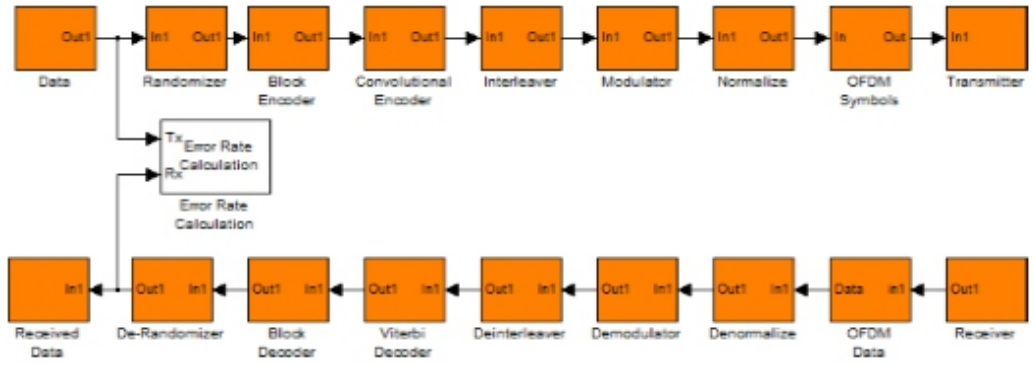

Figure 1 : WiMAX Physical Layer model

The Model itself consists of three main components namely transmitter, receiver and channel. Transmitter and receiver components consist of channel coding and modulation sub- components whereas channel is modelled as AWGN.

TABLE - 2
PARAMETERS FOR WIMAX MODEL

Scenario	16-Channel Full Bandwidth
Modulation	QPSK
RS Code Rate	3/4
CC Code Rate	1/2

QPSK = quadrature phase shift keying, RS = reed-solomon, CC = convolution coding.

III. CHANNEL CODING

Channel coding can be described as the transforming of signals to improve communications performance by increasing the robustness against channel impairments such as noise, interference and fading. The radio link is a rapidly changing link, often suffering from great interference. Channel coding, main tasks are to check and to correct the transmission errors of WiMax systems, must have a excellent performance in order to sustain high data rates. The 802.16 each channel coding chain is collected of three steps: Randomiser, Forward Error Correction (FEC) and Interleaving as per in figure 2. They are applied in this order at transmission. The corresponding operations at the receiver are applied in reverse order.

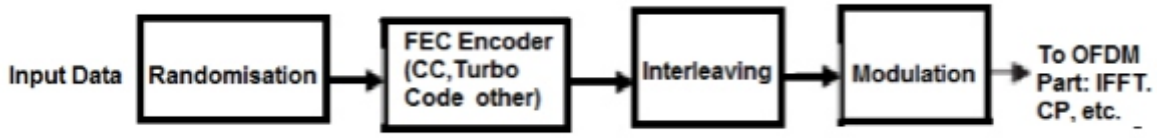

Fig. 2. OFDM physical transmission channel

A. Randomization

Randomisation starts protection by information-theoretic vagueness, avoiding long sequences of successive ones or successive zeros. It is useful for avoiding non-centred data sequences. Data randomisation is performed on each downlink and uplink burst of data.

Randomizer operates on a bit by bit basis. The purpose of the scrambled data is to convert long sequences of O's or 1's in a random sequence to improve the coding performance.

The Pseudo-Random Binary Sequence (PRBS) generator is used for randomisation is shown as per Figure 3. The generator defined for the randomizer is given by

$$1+ X^{14} + X^{15} \quad (1)$$

The bits issued from the randomiser shall be applied to encoder.

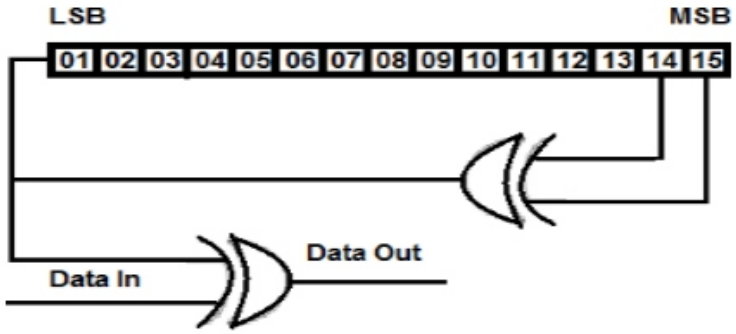

Fig. 3. Data Randomizer

A. Forward Error Correction (FEC)

Forward Error Correction is done on both the uplink and the downlink bursts and consists of concatenation of Reed-Solomon Outer Code and a rate compatible Convolutional Inner Code.

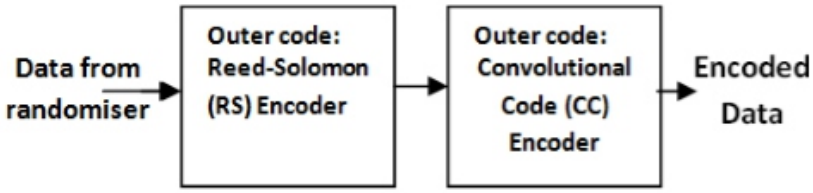

Fig. 4. Channel Coding

For OFDM physical, the RS-CC encoding is perform by first passing the data in block format through the RS encoder and then passing it through a convolutional encoder (Figure 4).

1) Reed-Solomon encoding

The purpose of using Reed-Solomon code to the data is to add redundancy to the data sequence. This redundancy addition helps in correcting block errors that occur during transmission of the signal.

A Reed–Solomon code is specified as RS(N,K) with T-bit symbols. The data points are sent as encoded blocks. The total number of T-bit symbols in an encoded block is $N = 2^T-1$. The number K, $K < N$, of uncoded data symbols in the block is a design parameter. Then, the number of parity symbols added is $N > K$ symbols (of T-bits each). The RS decoder can correct up to $(N - K)/2$ symbols that contain an error in the encoded block. WiMAX uses a fixed RS Encoding technique based on $GF(2^8)$ which is denoted as RS ($N = 255, K = 239, T = 8$).

Eight tail bits are added to the data just before it is presented to the Reed Solomon Encoder stage. This stage requires two polynomials for its operation called code generator polynomial g(x) and field generator polynomial p(x). The code generator polynomial is used for generating the Galois Field Array whereas the field generator polynomial is used to calculate the redundant information bits which are appended at the start of the output data.

Where:

N = Number of Bytes after encoding K = Data Bytes before encoding

T = Number of bytes that can be corrected

The following polynomials are used to generate systematic code:

Code generator polynomial:

$g(x) = (x - \lambda^0)(x - \lambda^1)(x - \lambda^2)\ldots(x\_ - \lambda^{2T-1}), \lambda = 02HEX$--(2)

Field generator polynomial:

$p(x) = x^8 + x^4 + x^3 + x^2 + 1$ (3)

2) Convolutional Encoding

Convolutional codes are used to correct the random errors in the data transmission. A convolutional code is a type of FEC code that is specified by CC(m, n, k), in which each in- bit information symbol to be encoded is transformed into an n-bit symbol, where m/n is the code rate (n > m) and the transformation is a function of the last k information symbols, where k is the constraint length of the code.

To encode data, start with k memory registers, each holding 1 input bit. All memory registers start with a value of 0. The encoder has n modulo-2 adders, and n generator polynomials. In WiMAX Physical Layer each RS block is encoded by the binary convolutional encoder, which has a code rate of 1/2 and a constraint length equal to 7. This encoder has two binary adders X and Y and uses two generator polynomials, A and B.

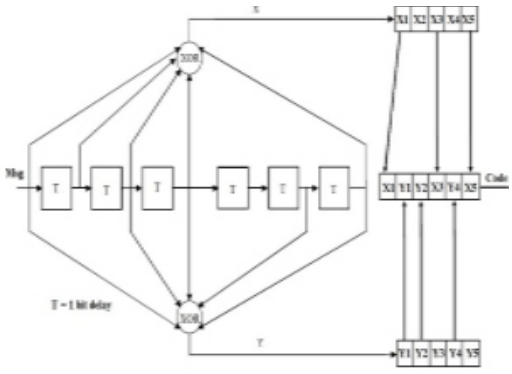

Fig. 5. FEC convolution and encoding

These generator polynomial codes are:

A = 171 octal = 1111001 binary for X (4)

B = 133 octal = 1011011 binary for Y (5)

The output of the convolutional encoder is then punctured to remove the additional bits from the encoded stream. The number of bits removed is dependent on the code rate used one for each adder.

II. INTERLEAVING

Interleaving is used to protect the transmission against long sequences of consecutive errors, which are very difficult to correct. These long sequences of error may affect a lot of bits in a row and can then cause many transmitted burst losses. Interleaving, by including some diversity, can facilitate error correction. The encoded data bits are interleaved by a block interleaver with a block size corresponding to the number of coded bits per allocated subchannels per OFDM symbol. The interleaver is made of two steps:

•Distribute the coded bits over subcarriers.

A first permutation ensures that adjacent coded bits are mapped on to nonadjacent subcarriers.

•The second permutation insures that adjacent coded bits are mapped alternately on to less or more significant bits of the constellation, thus avoiding long runs of bits of low reliability.

All encoded data bits shall be interleaved by a block interleaver with a block size corresponding to the number of coded bits per the allocated subchannels per OFDM symbol, Ncbps.the interleaver is defined by a two step permutation. the first ensures that adjacent coded bits are mapped onto nonadjacent subcarriers.the second permutation insures that adjacent coded bits are mapped alternatively onto less or more significant bits of the constellation, thus avoiding long runs of lowly reliable bits.

Let N_{cpc} be the number of coded bits per subcarrier,i.e.1,2,4 or 6 for BPSK,QPSK,16- QAM,or 64-QAM,respectively. Let s=ceil(N_{cpc}/2).within a block of N_{cbps} bits at transmission, let k be the index of the coded bit before the first permutation; f_k be the index of that coded bit after the first and before the second permutation; and let s_k be the index after the second permutation, just prior to modulation mapping.

The first and second permutation is defined by equ. (1), (2)

$$f_k = (N_{cbps}/12).k_{mod}12+floor(k/2) \qquad k = 0,1,2,\ldots..N_{cbps}-1 \quad (1)$$

$$s_k = s.floor(f_k/s) + (m_k + N_{cbps} - floor(12.m_k/N_{cbps}))_{mod(s)} \quad k=0,1,2,\ldots\ldots N_{cbps}-1 \quad (2)$$

where, N_{cpc}= Number of coded bits per carrier,

N_{cbps}= Number of coded bits per symbol,

K=Index of coded bits before first permutation,

m_k=Index of coded bits after first permutation,

j_k=Index of coded bits after second permutation

The De-interleaver, which performs the inverse operation, is also defined by two permutation. Within a received block of N_{cbps} bits, let j be the index of a received bit before the first permutation; f_j be the index of that bit after the first and before the second permutation; and let s_j be the index of that bit after the second permutation, just prior to delivering the block to the decoder.

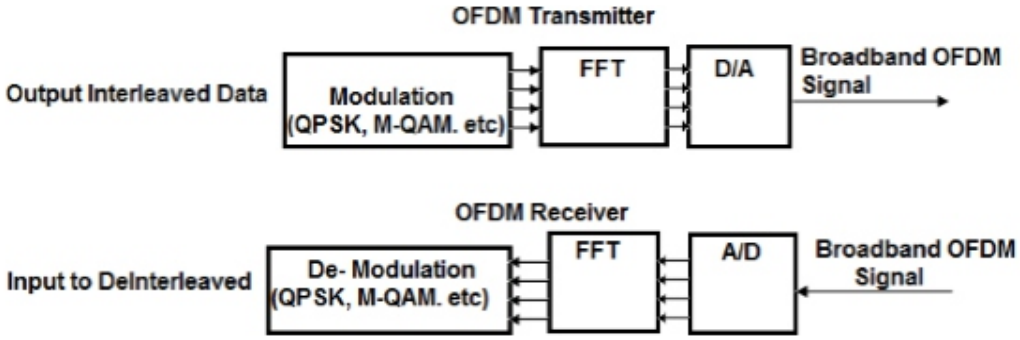

Fig. 6. FEC convolution and encoding

The first and second permutation is defined by equ. (3), (4)

$f_j = s.floor(j/s)+(j + floor(12.j/N_{cbps}))_{mod(s)}$

where j=0,1,…..N_{cbps}-1 (3)

$s_j = 12.fj – (N_{cbps}-1).floor(12.fj/N_{cbps})$

where j=0,1,2…… ……..N_{cbps}-1 (4)

where, N_{cpc} = Number of coded bits per carrier

N_{cbps} = Number of coded bits per symbol

K = Index of coded bits before first permutation

m_k = Index of coded bits after first permutation

j_k = Index of coded bits after second permutation

The first permutation in the de-interleaver is the inverse of the second permutation in the interleaver, and conversely. Below table show the bit interleaver sizes as function of modulation and coding. The first bit out of the interleaver shall map to th MSB in the constellation.

TABLE – 3 BLOCK SIZES OF THE BIT INTERLEAVER

	Default (16 subchannels)	8 subchannels	4 subchannels N_{cbps}	2 Subchannels	1 subchannels
BPSK	192	96	48	24	12
QPSK	384	192	96	48	24
16- QAM	768	384	192	96	48
64-QAM	1152	576	268	144	72

III. MODULATION

As for all recent communication systems, WiMAX/802.16 uses digital modulation. Four modulations are supported by the IEEE 802.16 standard: BPSK, QPSK, 16-QAM and 64- QAM. In this section the modulations used in the OFDM and OFDMA Physical layers are introduced for modulations. In the modulation phase the coded bits are mapped to the IQ constellation, starting with carrier number -100 on up to carrier number +100. To simplify transmitter and receiver designs, all symbols in the FCH and DL data bursts are transmitted with equal power by using a normalization factor.

IV. OFDM SYSTEM IMPLEMENTATION

The digital implementation of OFDM system is achieved through the mathematical operations called Discrete Fourier Transform (DFT) and its counterpart Inverse Discrete Fourier Transform (IDFT). These two operations are extensively used for transforming data between the time domain and frequency domain. In case of OFDM, these transforms can be seen as mapping data onto orthogonal subcarriers. In practice, OFDM systems employ combination of fast fourier transform (FFT) and Inverse fast fourier transform (IFFT) blocks which are mathematical equivalent version of the DFT and IDFT.

At the transmitter side, an OFDM system treats the source symbols as though they are in the frequency domain. These symbols are feed to an IFFT block which brings the signal into the time domain. If the N numbers of subcarriers are chosen for the system, the basis functions for the IFFT are N orthogonal sinusoids of distinct frequency and IFFT receive N symbols at a time. Each of N complex valued input symbols determines both the amplitude and phase of the sinusoid for that subcarrier.

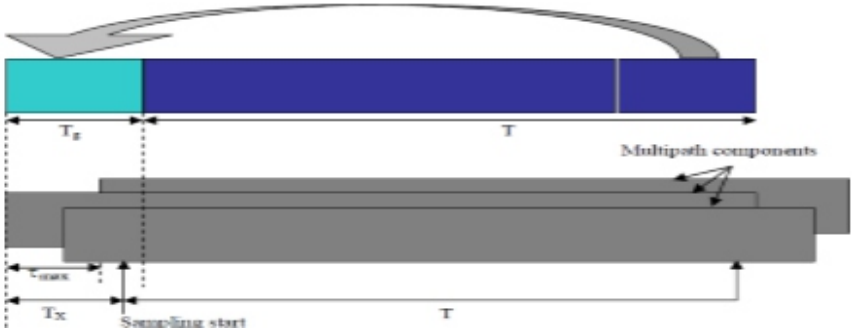

Fig. 7. Cyclic Prefix in OFDM

The output of the IFFT is the summation of all N sinusoids and makes up a single OFDM symbol. The length of the OFDM symbol is NT where T is the IFFT input symbol period. In this way, IFFT block provides a simple way to modulate data onto N orthogonal subcarriers. At the receiver side, The FFT block performs the reverse process on the received signal and bring it back to frequency domain.

A. Cyclic Prefix Addition

The subcarrier orthogonality of an OFDM system can be jeopardized when passes through a multipath channel. CP is used to combat ISI and ICI introduced by the multipath channel. CP is a copy of the last part of OFDM symbol which is appended to the front of transmitted OFDM symbol.

The length of the CP (T_g) must be chosen as longer than the maximum delay spread of the target multipath environment. Figure 6 depicts the benefits arise from CP addition, certain position within the cyclic prefix is chosen as the sampling starting point at the receiver, which satisfies the criteria $t_{max} < T_x < T_g$ where t_{max} is the maximum multipath spread. Once the above condition is satisfied, there is no ISI since the previous symbol will only have effect over samples within $[0, t_{max}]$. And it is also clear from the figure that sampling period starting from T_x will encompass the contribution from all the multipath components so that all the samples experience the same channel and there is no ICI.

V. THE WIMAX MODEL TEST RESULTS AND PERFORMANCE

The WiMAX standard document provides several test cases and test vectors for each test case. Below are the test results for each component in hexadecimal format.

Data Payload from the MAC Layer (29 bytes frame)
45 29 C4 79 AD OF 55 28 AD 87 B5 76 IA 9C 80 50 45 lB 9F D9 2A 88 95 EB AE B5 2E 03 4F

Data Frame after Randomization Stage (35 bytes frame)
D4 BA A1 12 F2 74 96 3027 D4 88 9C 96 E3 A9 52 B3 15 AB FD 92 53 07 32 CO 62 48 FO 19 22 E0 91 62 IA CI

Data Frame after Reed-Solomon Encoding (40 bytes frame)
49 31 40 BF D4 BA A1 12 F2 74 96 30 27 D4 88 9C 96 E3 A9 52 B3 15 AB FD 9253 07 32 CO 62 48 FO 19 22 E0 91 62 1A C1 00

Data Frame after Convolutional Encoding (48 bytes frame)
3A SE E7 AE 49 9E 6F IC 6F Cl 28 BC BD AB 57 CD BC CD E3 A7 92 CA 92 C2 4D BC 8D 78 32 FB3 BF DF 23 ED8A 94 16 27 AS 65 CF 7D 16 7A 45 B8 09 CC

Data Frame after Interleaving (48 bytes frame)
77 FA 4F 17 4E 3E E6 70 E8 CD 3F 76 90 C4 2C DB3 F9 B7 F13 43 6C Fl 9A BD ED OA IC D8 lB EC 9B 30 15 BA DA 31 F5 50 49 7D 56 ED B4 88 CC 72 FC SC

Based on the model presented in this paper, and tests carried out, the performance was established based on 10 million symbols in each case. The performance is displayed in the following figure time-scatter plots for 10, 20 and 30dB; time-scatter plot for the output from the transmitter and the transmitted signal.

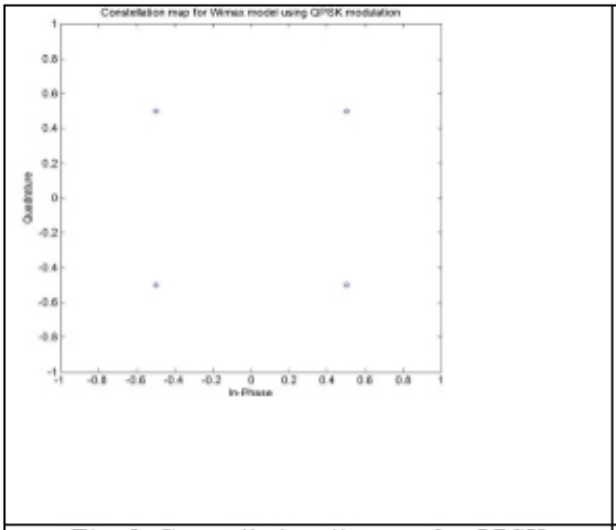

Fig. 8. Constellation diagram for QPSK modulation

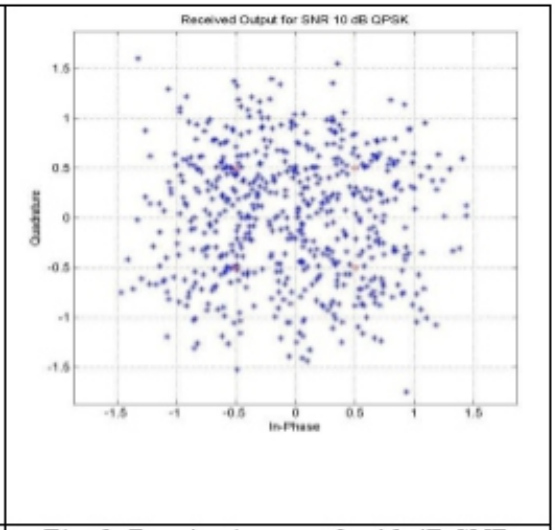

Fig. 9. Received output for 10 dB SNR

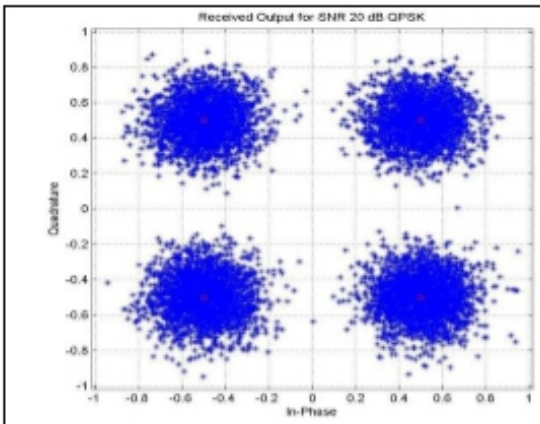

Fig. 10. Received output for 20 dB SNR

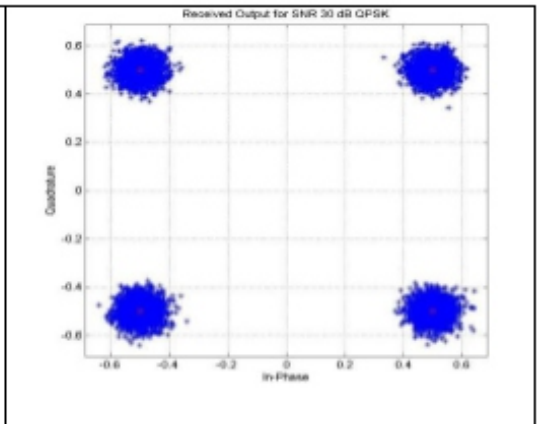

Fig. 11. Received output for 30 dB SNR

The time-scatter plots demonstrate the scattering of the transmitted and received signals at different values of the Signal-to-Noise Ratios.

VI. CONCLUSION

The model built in this paper demonstrates the importance of modelling a system to understand its functionality. Tests can the carried out on the model to calculate the performance indicators. The results of the simulation from the models will enable the researchers to choose the best option for their requirements. As we increase the SNR then our received scattered data approaches to transmitted scattered data.

ACNOWLWDGEMENT

I am kindly thankful to almighty who has given me the potential to reach at this level. I am also thankful to my Principal sir and my HOD who has given me constant inspiration to participate in the conference of such a remarkable level. I am also thankful to all those people who had directly or indirectly helped me to prepare this paper. At last, I can't forget to thank to my parent who give me constant motivation to do innovative things.

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