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Highlights

Bound based On-Chip

A New Proposed Algorithm

Fuzzy Cognitive Map

Analysis of Quickreduct

Discovering Thoughts, Inventing Future

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Performance Analysis of Quickreduct, Quick Relative Reduct Algorithm and a New Proposed Algorithm

By Ashima Gawar
GGSIPU, India

Abstract- Feature Selection is a process of selecting a subset of relevant features from a huge dataset that satisfy method dependent criteria and thus minimize the cardinality and ensure that the accuracy and precision is not affected ,hence approximating the original class distribution of data from a given set of selected features. Feature selection and feature extraction are the two problems that we face when we want to select the best and important attributes from a given dataset Feature selection is a step in data mining that is done prior to other steps and is found to be very useful and effective in removing unimportant attributes so that the storage efficiency and accuracy of the dataset can be increased. From a huge pool of data available we want to extract useful and relevant information. The problem is not the unavailability of data , it is the quality of data that we lack in.. We have Rough Sets Theory which is very useful in extracting relevant attributes and help to increase the importance of the information system we have. Rough set theory works on the principle of classifying similar objects into classes with respect to some features and those features may collectively and shortly be termed as reducts.

Keywords: data mining, rough set, quickreduct, quick relative reduct, feature selection, feature extraction.

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Performance Analysis of Quickreduct, Quick Relative Reduct Algorithm and a New Proposed Algorithm

Ashima Gawar

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In this paper, we have discussed Quickreduct and Quick Relative Reduct algorithm and also proposed a new algorithm. A comparative study between these two algorithms is also done. The experimental results show that Quick Relative Reduct algorithm is better than Quickreduct algorithm. The analysis is carried out on synthetic datasets.

Keywords: data mining, rough set, quickreduct, quick relative reduct, feature selection, feature extraction.

I. Introduction

a) Feature Selection and Feature Extraction

It to the process of finding out and select minimum subsets of attribute from a large set of original attributes and finally select the minimal one. The aim behind the process is to reduce dimensions across the datasets, remove the attributes which have no significance and identify the most important and useful attributes. (Zhang et al., 2003) It will help in improving and increasing accuracy and lessen the time that the algorithm will take for its computation.

We have organized the remaining paper as follows : section 2 briefs about the data set used for the study. Section 3 describes the Quickreduct algorithm. Section 4 describes Quick Relative Reduct algorithm. Section 5 explains the analysis of the comparison made between the Quickreduct and the Quick Relative Reduct algorithm. Section 6 suggests some improvement in the QuickReduct algorithm and finally Section 7 states the conclusion of the paper.

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b) Reducts

The minimal set of attributes that will identify the other attributes of the dataset thus improving its accuracy and efficiency are called reducts.(Jothi and Inbarani , October 2012) Mathematically , a reduct of an algebraic structure that is calculated by removing some of the operations and relations of the mathematical structure we are using. In a reduct we keep only those attributes that are similar in nature and consequently have the goal of set approximation . Usually we can find several such subsets and those which are minimal among those are called reducts.

Given an information table S, an attribute set R _
At is called a reduct, if R satisfies the two conditions:

1. IND(R) = IND(At);
2. For any a € R, IND(R – {a}) ≠ IND(At).

c) Rough Sets

Rough set theory provide a novel methodological approach for approximation of large sets and describing the knowledge. In rough set theory firstly we collect a sample object set and store the feature values in information tables. Rough sets help us to find reducts without deteriorating the original quality of the dataset.

Characterization of Rough sets cannot be done in terms of information about the elements of rough sets. With every rough set a pair of precise sets, known as the lower and the upper approximations of the rough set. The lower approximation contains all the objects which definitely belong to the set and the upper approximation contains all objects which may possibly belong to the set. The difference between the upper and the lower approximation constitutes the boundary region of the rough set. Approximations are the fundamental concepts of rough set theory.

Rough set theory can be described as a formal methodology that can be employed to reduce the dimensions of datasets and is used as an preprocessing step to data mining. The reduced

dimensionality improves the runtime performance of an algorithm. Rough Set theory (Suguna and Thanushkodi , 2010) is a mathematical approach that is based on the principle that if the degree of precision in a dataset is lowered then we can more easily visualize the data patterns. The main aim is to approximate the lower and upper bounds. Rough set based data analysis initially analyses the data table called decision table in which the columns are labeled by attributes and rows represent the objects. The entries of the table will contain the value of the attributes . Attributes of the decision table are divided into two disjoint groups which are called decision and condition attributes respectively. Any rough set is associated with a pair of precise sets which are called the lower and upper approximations of the rough set is associated (Yiyu and Yan 2009).

II. Data Preparation

We have manually performed analysis on the test datasets . The first dataset contains information about AUTOMOBILE and the second one contains information contains data about COMPUTER.

III. Quickreduct Algorithm (QR)

In Quickreduct algorithm we remove the attributes so that the set we get after reduction provides the same prediction of the decision feature as the original set which is achieved by comparing equivalence relations generated by sets of attributes. The attribute selected for the first time is to be included in the reduct set in the Quickreduct algorithm (Velayutham and Thangavel, September 2011) is the degree of dependency of that attribute which is not equal to zero..The algorithm tries to find out a minimal reduct without generating all possible subsets . Initially we take an empty set and add in the empty set R those attributes that will result in the greatest increase in dependency value one by one until we get the maximum possible value for the dataset.

Algorithm

1. R ← { } // empty set
2. Do
3. T ← R // take T
4. For all x € (C-R) // C is the core
5. If Y RU{x} (D) >YT(D)
6. T←R U {x}
7. R ←T
8. Until YR(D) == YC(D)
9. Return R

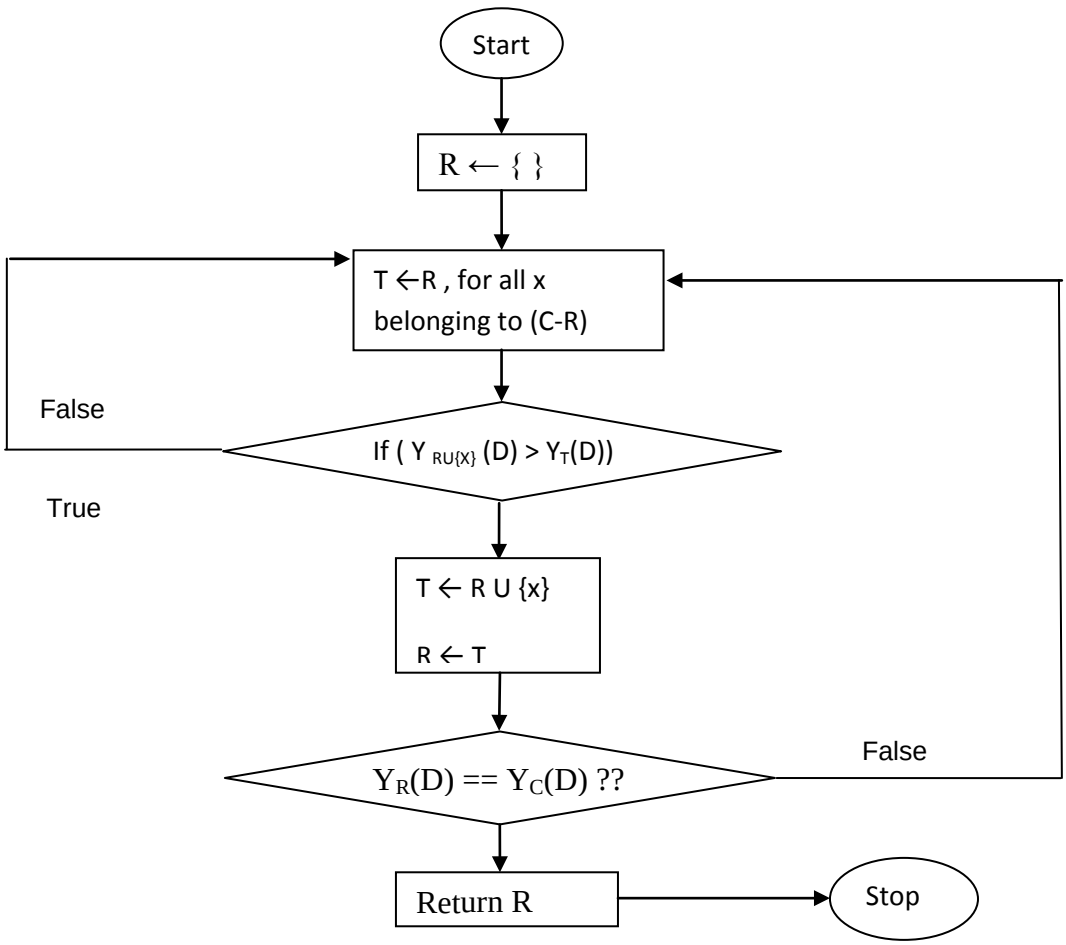

Figure 1: Stepwise execution of Quickreduct algorithm

IV. Quick Relative Reduct Algorithm

In Quick Relative Reduct (Kalyani and karnan 2011)algorithm we find out the degree of relative dependency after removing the attributes from the set. If a attribute is removed and it causes the value of relative dependency to be one then that attribute is eliminated otherwise it is put in the core reduct. The process is repeated again and again till the value becomes one.
The algorithm is explained below :

The algorithm is explained below :

Algorithm

1. R ← { list of conditional attributes }
2. Select x ← Conditional attribute from R
3. If dependency =1
4. Then "Eliminate the attribute "
5. Else
6. R ← { list of reduct }
7. End

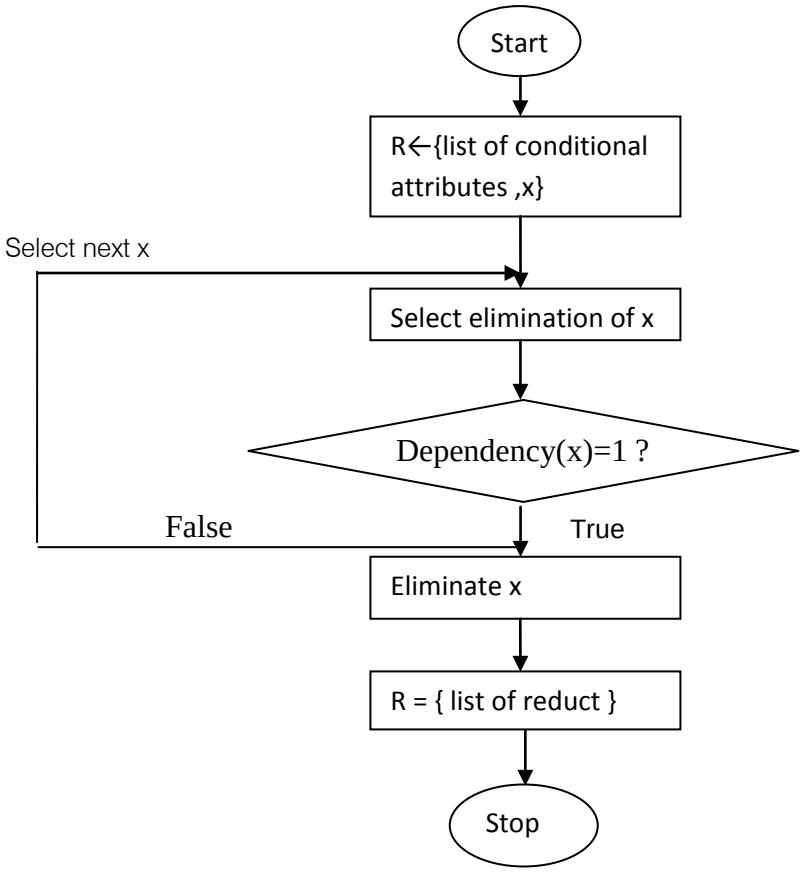

Figure 2 : Stepwise execution of Quick Relative Reduct algorithm

V. Performance Analysis

Table 1 : Results for Quick Reduct

Date set	Attributes	Instances	Selected Attributes	Reduct ?	Optimal ?
Automobile	4	8	3	Yes	Yes
Computer	6	20	4	Yes	No

Table 2 : Results for Quick Relative Reduct

Date set	Attributes	Instances	Selected Attributes	Reduct ?	Optimal ?
Automobile	4	8	3	Yes	Yes
Computer	6	20	3	Yes	Yes

Both Quick Reduct and Quick Relative reduct are reduct algorithms but the Quick Relative Reduct is a more efficient algorithm as it calculates reducts without calculating discernibility functions which can be expensive. It includes a simple approach using relative dependency.

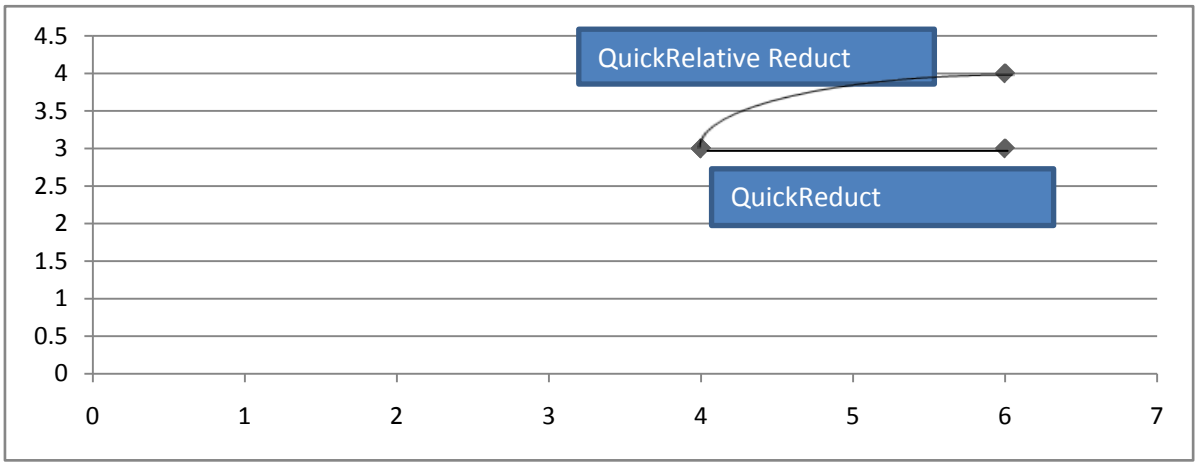

Figure 3 : Graph depicting performance analysis

VI. Proposed Algorithm

We propose a new algorithm to overcome the disadvantage of Quick Relative Reduct that in this algorithm we calculate relative dependency and the attribute is chosen with highest degree of dependency. When the highest relative dependency value is possessed by more than one attribute. For that purpose we can introduce a significance factor associated with every attribute and choose the attribute with greater significance.

Significance factor (Jothi and Inbarani 2012) is defined as :

Assume X ⊆ A is an attribute subset, x€A is an attribute, the importance of x for X is denoted by Sig X (x) = 1- |X U {x} | / |X| Where |X|=|IND(X)|. Suppose U/IND(X) = U/X={X1, X2 …Xn},then |X| = |IND (X) | = ∑ | Xi | 2 . |X| - |X U {x} | represents the decrement of indiscernibility and also the increment of discernibility as attribute x is added to X. The number of selection methods is originally indiscernible in X, but it is discernible in X u {x} and the increment of indiscernibility is expressed by :

$$(|X| - |X \cup \{x\}|)/X = 1 - |X \cup \{x\}|/X \qquad (6.1)$$

Proposed Algorithm :

Input : x : conditional attributes

Step 1: Take the R as the set of all conditional attributes.

Step 2 : Now select the conditional attribute.

Step 3 : Calculate the relative dependency of the attribute.

Step 4 : If relative dependency of the attribute is one then eliminate the attribute , Go to step 2.

Step 5: If relative dependency is not equal to one then select the highest dependency attribute ,if two attributes have same relative dependency then select the one with greater significance.

Step 6 : R = { list of reduct }

Step 7 : Stop

Output : Reduct

VII. Conclusion

In this we discussed the comparison analysis of the Quickreduct and the Relative QuickReduct algorithm. The Relative QuickReduct algorithm finds reducts based on backward elimination of attributes and the QuickReduct algorithm finds reducts based on forward elimination. We also found out that Quick Relative Reduct was better than the QuickReduct algorithm. Also the Relative QuickReduct algorithm can be modified further to improve the efficiency by introducing the concept of significance factor. Further work can be carried out on the defined algorithm to explore its efficiency and accuracy. The analysis was performed manually but the research can be carried out further for further suggestions and improvements.

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Energy Efficient Branch and Bound based On-Chip Irregular Network Design

By Kalpana Jain, Naveen Choudhary & Dharm Singh
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Abstract- Here we present a technique which construct the topology for heterogeneous SoC, (Application Specific NoC) such that total Dynamic communication energy is optimized. The topology is certain to satisfy the constraints of node degree as well the link length. We first layout the topology by finding the shortest path between traffic characteristics with the branch and bound optimization technique. Deadlock is dealt with escape routing using Spanning tree. Investigation outcome show that the proposed design methodology is fast and achieves significant dynamic energy gain.

Keywords: *network on chip, shortest path, branch and bound, routing.*

GJCST-C Classification: *C.2.1*

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Energy Efficient Branch and Bound based On-Chip Irregular Network Design

Kalpana Jain [α], Naveen Choudhary [σ] & Dharm Singh [ρ]

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I. Introduction

Interconnection networks are used to meet the communication demands of the numerous processing elements in high end parallel supercomputers, telecom switches and more recently their wide spread use is also seen for the communication requirement in complex SoC[1] having numerous processing elements. With the development of integration technology, System on Chip composed of numerous cores on a single chip has entered the billion transistor era. As the microprocessor industry moves from single core to multi core architectures, requiring efficient communication among processor. A high performance, flexible, scalable and design friendly interconnection network design is highly preferred for new SoC and chip designs. These interconnection networks for complex SoC also referred as on chip Networks. Network on chip have emerged as a viable option for scheming scalable messaging architecture for MPSOCs .In Noc, on chip micro networks are used to intersect the various cores, which are better than bus based systems, so used for dealing communication issues. Early works are done for standard topologies like mesh, torus etc where traffic cannot be statically predicted however challenges are different for diverse SoC with different core size, operation and communication requirement. In Irregular NoC each node can be connected to one or more core, as per the constraint and design requirement and therefore are best suited for application specific custom NoC design [2, 3]. Here we propose a branch and bound [B&B] based heuristics for the design of customized energy efficient irregular NoC assuming an area optimized floor plan as a prerequisite.

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II. Communication Energy and Irregular NOC

Design of Irregular Network on Chip has two main issues to be dealt with respect to the proposed work that is calculating energy dissipated through the network for data transfer and finding the routes between the cores of network. Thus here we discuss the Energy Model and Routing methods used.

a) Energy Model

Ye et al. [4] proposed a model for communication for on chip networks. For regular networks the channels length between the cores is of uniform length. Thus the energy dissipated in transferring 1 bit of data from soured core to destination core comprising of both router energy and channel energy is as follows:

Router Energy: (E_{Rbit})

$$E_{Rbit} = E_{Sbit} + E_{Bbit} + E_{Wbit} \quad (1)$$

Where $E_{Sbit} + E_{Bbit} + E_{Wbit}$ correspond to the dynamic energy elapsed by switch(E_{Bbit}), buffering(E_{Bbit}) and interconnection links (E_{Wbit}) within the switching framework. The dynamic energy dissipated on the channels between cores (E_{Lbit}) should also be considered, thus the dynamic energy dissipated in transferring one bit of information from a tile to its adjacent tile can be given as

$$E_{bit} = E_{Rbit} + E_{Lbit} \quad (2)$$

Thus the communication_energy required in sending 1 bit of information from source tile t_j to destination tile tile t_k is

$$E^{jk}\,bit = nhops * E_{Rbit} + (nhops - 1) * E_{Lbit} \quad (3)$$

Where nhops is sum of tiles from source tile tj to destination t_k and E_{Lbit} is channel length between adjacent tiles (channel length is uniform for all adjacent tiles of regular networks).

For irregular networks the channel length is not of uniform (equal), as channels are laid by maximum length constraint of link length. Thus the second operand of eq-3 is replaced as the summation of energy dissipated by each channel in the route of source tile t_j to destination tile t_k

b) Routing in Irregular NoC

The popular routing algorithms with irregular topologies such as Left-Right routing [8], up -down routing[6] etc, uses the turn based model [7] to overcome deadlock state. In the proposed work minimum shortest paths are laid as preferred routing paths from the source tile to destination tile with a view to optimize communication energy requirements, however a methodology based on escape route[5] is used to achieve deadlock freedom in communication.

III. Proposed Methodology for Energy Efficient Branch and Bound based on Chip Irregular Network Design

In the presented work, an energy efficient topology design is proposed. To design the energy efficient topology the, the channels laid should be such that they lead to shortest path for communication, this is achieved by finding the shortest path application communication characteristics, considering the constraints of node degree and length of channel as maximum length should not be exceeded due to physical signaling delay. Moreover the connectivity of network is assured by creating spanning tree for the network and a constraint according to up/down routing, is used to achieve the deadlock freedom in communication.

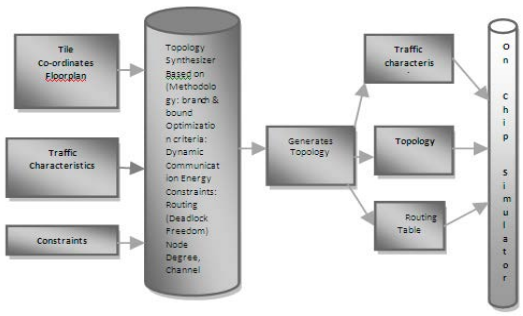


Figure1: Design flow of Energy Efficient Branch and Bound based On-Chip Irregular Network Design

The application characteristics are clustered according to the source traffic, and then using the shortest energy path as the optimization criteria and a branch and bound method is developed to get an customized energy efficient irregular on-chip network then the source with the maximum data rate are routed using shortest path and branch and bound method used to get the optimized solution.

The design flow is given in figure 1 shows the input taken for topology synthesizer such as traffic characteristics, constraints and tile coordinates for Manhattan distance to lay the channel.

a) Branch and Bound (B&B) Topology Generation

A branch and bound [19] based optimization technique is developed to design a dynamic communication energy efficient methodology, which is custom tailored according to the traffic requirement (predefined) with the necessary constraints of node degree , channel length and routing. Figure 2 shows the partial representation of nodes generation of tree, traffic requirement is routed at each stage to form the efficient communication energy topology.

The nodes of the tree can be one of the following types:

Root: traffic characteristics are not routed and represent the problem (energy efficient topology) to be optimized.

Internal node: Each number in the label represents the Priority of traffic characteristics which are routed. For example node 201XX represents the partial routing of traffic characteristics with priority number 2, 0, 1. While traffic characteristics with priority 3 and 4 are still unrouted.

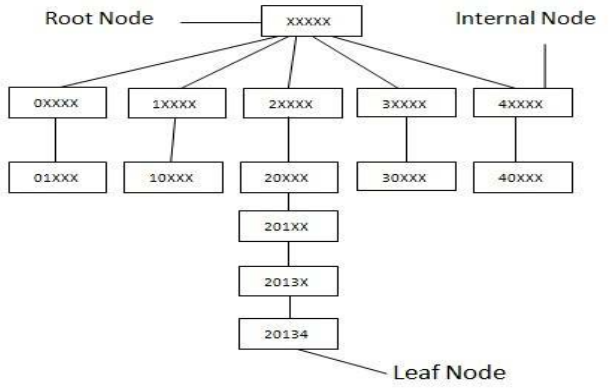


Figure 2 : partial nodes representation of tree.

Leaf: All the traffic characteristics are routed and topology is created, select leaf node one with minimum cost.

Every node is associated with cost, UBC:Upper bound cost and LBC:lower bound cost

Cost: The cost of node is energy consumed in communication for routed traffic characteristics.

UBC and LBC are cost of the nodes which helps us to determine the whether the nodes lead to optimal solution and helps in not making the search exhaustive.

Finding optimal solution for the problem of efficient communication energy topology is searching leaf node with minimum cost. Branch is expansion(create child node) at each node by routing next application characteristics to be routed, and bound is check on child nodes whether they lead to the better solution. This checking is achieved by comparing their UBC and LBC with the global UBC and parent node. If cost or LBC is greater than global_min_UBC child nodes are discarded.

b) The calculation of UBC and LBC

UBC calculation: UBC of node is calculated by finding path of all remaining unrouted traffic characteristics using a greedy method for remaining unrouted traffic characteristics.For each step in the greedy method , the next unmapped application characteristics with highest communication demand is selected and its path is laid by shortest path method. This step is repeated until all application are routed. This leads to a complete routing and identifies a leaf node. If this node is illegal then it is discarded otherwise saved for the future expansion.

LBC calculation: LBC of node is calculated by finding path of all remaining unrouted application characteristics, here constraints of topology are not considered in path setup. This step is repeated for all remaining unrouted traffic characteristics.

Priority Queue is used to speed up the search for optimal leaf node; the nodes are inserted in sorted order of their cost, once the Queue is full, nodes are inserted only if they are leading to better solution.

c) The Proposed methodology: Algorithm

```
Sort the traffic characteristic by communication volume
setmin_UBC=infinity,Gcost=infinity ,
Best_maping=NULL

Create first level nodes of for all source traffic if they have any
communication demand and insert in the priority queue.

While( pqueue is not empty)
{
curnode= pqueue_next();
for each unrouted traffic characteristics , find
the shortest path and create a new child
If(newchild_LBC > min_UBC)
        discard the newchild
If(newchild_LBC > parent_UBC)
        discard the newchild
If (newchild is leaf node)
 {
    if(Best_maping is NULL)
       Best_maping=newchild
   else
   {if(best_maping.cost > newchild.cost)
       Set Best_maping to newchild
   }
 }
Else
  If(min_UBC > newchild.UBC)
      set min_UBC= newchild cost
  Insert newchild into pqueue
}

Set escape path for given traffic characteristics and construct
the tables required for the On Chip simulator.
```

IV. Experimental Results

The random data sets required to evaluate the proposed methodology was generated using TGFF [18] with diverse communication data rate of the cores. An On Chip simulator is used for evaluation. The router energy dissipated is evaluated using the power simulator Orion[15,20] for 0.18µm technology. The dynamic bit energy dessipated for inter-node link (ELbit) can be computed using the below equation.

$E_{Lbit} = (1/2) \times \alpha \times C_{phy} \times V_{DD}^2$

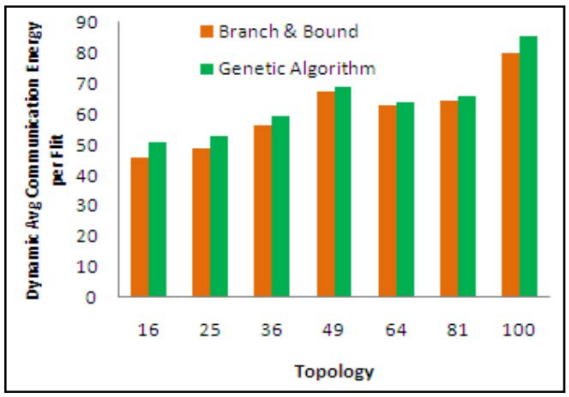
Where

1. α = average probability of a one to zero or zero to one transition between two successive samples in the stream for a specific bit, assured average value of $\alpha = 0.5$.
2. C_{phy} = physical capacitance of inter-node wire.
3. V_{DD} is the supply voltage.

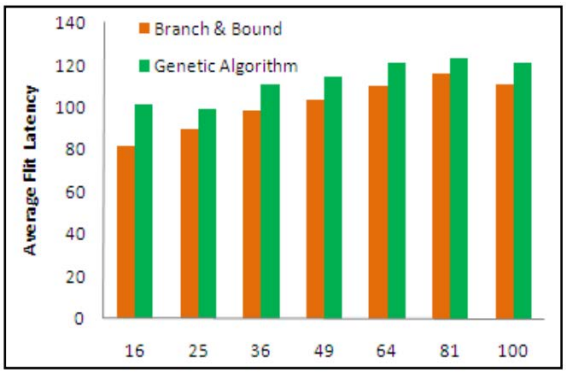
a) B&B comparison with Genetic on Random and Realistic Benchmarks

Below graphs shows the evaluation comparison of proposed methodology with Genetic algorithms based methodology proposed [14] by Naveen Choudhary et al. for the similar data sets (tile co-ordinates and traffic characteristics) with Node_ degree =4 and link length as twice the length of the Maximum core size.

Below Graphs shows the performance comparison of Branch and Bound and [14] over 100 sets of diverse application data. Average flit latency gain in the range of 5% to 20% and average communication energy gain in the range of 2% to 10% in comparison to [14] has achieved by the topologies generated by the proposed B&B method.

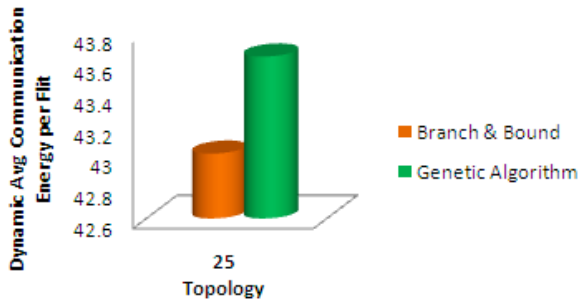


a. Average Communication Energy per flit

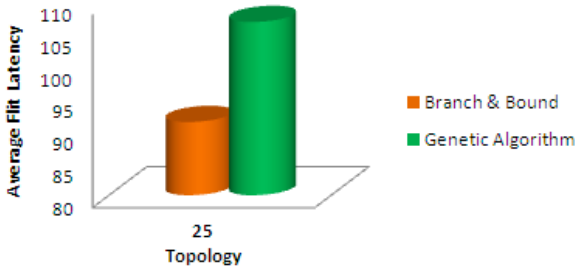


b. Average flit latency

Figure 3 : Performance comparison of proposed methodology with genetic approach on Random Benchmark. (a)Average Communication Energy per flit and (b) Average flit latency



a. Average Communication Energy per flit



b. Average Flit Latency

Figure 4 : Performance comparison of proposed methodology with genetic approach on realistic benchmark. (A).Average Communication Energy per flit and (b) Average flit latency

V. Conclusion

The paper present a B&B based technique for designing an energy efficient custom tailored topology for Irregular on-chip networks. The customized topology is design as per the predefined traffic requirements. The necessary constraint of max node degree, max channel length, deadlock free communication and area optimized floor plan are incorporated in the proposed methodology provides a realistic solution .The results clearly elaborates that the proposed method is able to generate better energy efficient networks in comparison to the popular evolutionary based approach[14].

The proposed work can be further extended in a quite few ways such as incorporating the floor plan also in the proposed methodology which can be expected to provide improved energy efficient networks may be at the cost of increased area overhead. Another extension of the proposed work can be in the area of designing irregular 3D on-chip energy efficient networks.

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Pricm – A Framework for Project Management

By Nida Waheed, Athar Mohsin & Dr. Sarmad Sadik
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Abstract- In today's world, project management is a rapidly developing area. The various models and frameworks available to implement a project vary according to the nature of the project. However, not all of them are applicable to all types of projects. This paper describes a project management framework, PRICM, which is a combination of CMMI, PRINCE2 and PMBOK. The framework integrates these three technologies. Key process areas of CMMI are aligned with PRINCE2 while tools and techniques are taken from PMBOK. The already available framework of PRINCE2 was used as a guide in developing a new one. Research was done to make a new framework for project management that can be used to handle projects of various nature and sizes.

Keywords: project management, PRICM, framework, key process areas, CMMI, PRINCE2, PMBOK, tools and techniques.

GJCST-C Classification: D.3.3

PRICMAFRAMEWORKFORPROJECTMANAGEMENT

Strictly as per the compliance and regulations of:

Pricm – A Framework for Project Management

Nida Waheed [α], Athar Mohsin [σ] & Dr. Sarmad Sadik [ρ]

Abstract- In today's world, project management is a rapidly developing area. The various models and frameworks available to implement a project vary according to the nature of the project. However, not all of them are applicable to all types of projects. This paper describes a project management framework, PRICM, which is a combination of CMMI, PRINCE2 and PMBOK. The framework integrates these three technologies. Key process areas of CMMI are aligned with PRINCE2 while tools and techniques are taken from PMBOK. The already available framework of PRINCE2 was used as a guide in developing a new one. Research was done to make a new framework for project management that can be used to handle projects of various nature and sizes.

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I. Introduction

Project management is a growing field. In coming years, it will be one of the most practiced disciplines. It is the skill of controlling and organizing different parts of a project. It may include making of a new product, expansion of a business or even a wedding plan.

According to PMI [1], "a project is a temporary group activity designed to produce a unique product, service or a result." It is temporary because it has defined start and an end. It is unique since it includes activities, which are not carried out daily. A project requires and uses resources like people, money and time. It can be very small to a big one comprising teams from around the world. Construction of a plaza, expansion of a business even writing a code is all projects. It provides useful techniques and knowledge for making a project.

According to [2], "a management in all organizational and business activities is the act of coordinating the efforts of people to accomplish desired goals and objectives using available resources efficiently and effectively." This contributes to the concept of Project Management. It includes managing project consisting of small teams to a project consisting of expanding a business to geographical level.

Project management is thought to have three main components time, money and scope. Increasing or decreasing one affects the others. Project managers have to use these resources skillfully so that none of the three is exhausted.

Baars [3] says the six phases of initiation, definition, design, development, implementation and follow up form the basis of all the methods. By dividing a project into smaller phases, handling the project team and division of workload between them becomes easier. In addition, it leads a project towards the right direction.

II. Background

This area has expanded in past years and will continue to expand in coming years. According to Kerzner [4], "The growth and acceptance of project management has significantly changed over the past forty years, and these changes are expected to continue well into the twenty-first century, especially in the area of multinational project management."

Many of today's projects fail because of unrealistic time scales. This is because time is decided before the project start and is unchangeable afterwards. Another reason is lack of proper communication between the team members and the project managers. This leads to improper requirements choice and hence failure. Yet another reason is insufficient resources for a project. When properly applied, it results in better use of financial, human resources, and time constraints.

III. Literature Review

The literature identifies the research done to investigate project management frameworks and various development methods. According to Ana et al. research [5], CMMI works with SCRUM. This way small teams use it as a starting method without defined processes. Research indicates that it can help organizations to make a new project management framework based on both practices. While Ana et al. suggest this, Carsten et al. [6] claims combining it with SCRUM for more complex and larger projects. It shows how this combination handles increasing size and complexity.

Lina et al. [7] also suggest a combination of CMMI with Scrum, however, for small and medium sized organizations. The result is an improved project management framework for use in such organizations.

Zaidoun [8] and Jerzy et al. [9] both show that PRINCE2 works well with agile method XP. Both studies incorporate agility into PRINCE2's rigid structure However, [10] claims combining it with DSDM based on their product-driven nature.

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Taher et al. [11] study assesses PMM and CMMI to make a conceptual framework that fits into project management environment. In addition, it is easy to use it in various situations. Likewise, Felipe et al. [12] study attempts to make a maturity model for agile methodologies based on CMMI.

Ana et al. [4] and Jeff et al. [13] both claim that projects using combination of CMMI and agile methods like SCRUM produce better results. However, the former study does not specifically address small teams or organizations.

IV. The Objective

While these studies suggest integrating CMMI with agile practices like SCRUM and PRINCE2 with XP and DSDM, little research done on integrating these with each other. The study suggests combining CMMI with PRINCE2 to make a new framework while using tools, techniques from PMBOK.

V. Research Methodology

A methodology is the result of a series of studies carried out in a certain area or on a problem. It describes a new idea, a research, a finding or an innovation in that area. It puts into form the research or the study done. A methodology can be a framework of a new finding, a new working model or can be a way of doing something. It tells the pattern or a way of carrying out certain task or a project.

VI. Proposed Framework,the pricm

PRICM stands for PMBoK, Prince2 and Cmmi. The combination includes project management's proven framework of PRINCE2 while using CMMI's improvement approach and PMBOK's tools. The proposed framework incorporates their strengths and reduces weaknesses as much possible.

a) PRICM's Framework

The proposed framework is a combination of model of CMMI, PRINCE2 method and rules from PMBoK. PRICM utilizes PRINCE2's predefined method for how to and CMMI model for what to do and why to do while PMBOK for what.

VII. Proposed Framework

This section describes the proposed framework in detail. The framework implements the gaps identified in the previous studies. The study identified that work has been done to combine CMMI with SCRUM [5] [6] [7] and PRINCE2 with XP [8] [9] and DSDM [10]. Taher et al. [11] suggested a project management model by integrating these two with each other but it did not use PMBOK.

Likewise, research has been done on combining PRINCE2 with XP to incorporate flexibility into its rigid structure. The various studies suggested making a new project management framework by combining CMM and PRINCE2 with afore mentioned methods but no work is done to integrate the two with each other.

This research integrates CMM with PRINCE2 while using PMBOK's knowledge areas and rules. The rigid nature of PRINCE2 is made flexible so that it is applicable to smaller projects as well.

The framework consists of seven stages, five life cycle phases and the associated inputs and outputs. The inputs are the documents, charters, work planning whereas outputs are the work packages, milestones and results of that particular stage. In addition, each stage has initiation, planning, executing, monitoring and controlling and closing phases.

These five phases are basic steps of every project life cycle. Utilization of already available framework of PRINCE2 was helpful in making a new one. It does not incorporate only flexibility or strictness as either can result in a design that may be over-modified or cannot be modified at all.

Therefore, it was important to keep balance between these two qualities. It took into consideration previous design shortcomings, hence, resulted in a design that is simple in interface and use as well.

Fig.1 below describes the design of proposed framework. The figure is made in colors for better understanding of its stages, processes, documents, inputs, outputs etc. Arrows are also shown as solid and dotted lines for clear representation.

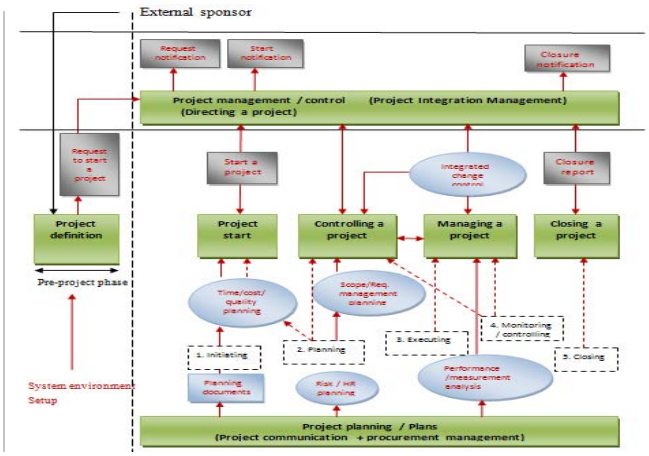

Figure 1: The Proposed Framework

a) Description of Framework

The solid green boxes are the main seven stages of this design; dotted black boxes show five phases that are present in every project's life cycle. Oval-shaped blue boxes are the knowledge areas from PMBOK; square grey boxes show the additional information or documents of stages. Solid red arrows are the links among stages, dotted red arrows show which of the five main phases are present in main stages. The black dotted line partitions the pre-project phase and the main project phase. The two solid black lines partition external sponsor, management and direction and project controls.

b) Detailed Description

The final design of framework was made according to already available framework of PRINCE2. The framework of PRINCE2 is not flexible enough resulting in some parts of projects falsely tailored. Moreover, it is not well suited for small projects. It is also document-centric and lacks proper analysis of requirements. CMMI's process areas, PMBOK's knowledge areas are combined along with PRINCE2's to make a framework best suited. The framework has seven stages and the associated inputs and outputs. Already available design of PRINCE2 is altered accordingly by combining CMMI's and PMBOK's knowledge areas. External sponsor or corporate management is the entity external to the project. The business aims of a project and the charter is prepared by the management and is then approved by the project board officials. The board also appoints the project team and project manager.

After authorization, the project starts. As it starts, overall schedule and plan of how it will be carried out is finalized. In addition, all the team members are assigned their respective tasks. Time, cost and quality factors are also discussed to ensure proper and optimal handling of all the available resources.

Since PRINCE2 lacks this, PMBOK's knowledge areas of time, cost and quality management help in ensuring this. At this point, the project is formally initiated.

Now project team members and manager are decided and tasks are assigned, planning on time, cost and quality is also done, the project goes into the next stage. This stage does all the important planning on project, including risk and human resource planning. During this stage, decisions and guidance on on-going activities of project are discussed with external management. If the project's scope or requirements need any changes, they are incorporated. Since PRINCE2 lacks proper requirements analysis and scope management, PMBOK's scope and requirements management areas assist in this. Moreover, integrated change control is used.

After incorporating any necessary changes, the project enters into the execution phase. At this stage, all staff and team members actually start executing their respective tasks. Proper communication with staff and stakeholders is a critical part of this phase. This communication creates a feedback, which is used for improvements. The communication can be through regular meetings with staff and manager, telephone calls or even interviews. While the project executes, monitoring and controlling is also done to ensure activities are going as planned. The management and planning phases run throughout the project to supervise all the activities.

When the project is done, it enters into the closing phase. This phase officially closes a project. The board members review the project for its completion and a closure report is issued along with the closure notification. This notification is sent to the external authority after approval. It officially closes a project.

c) Detailed Design

Fig.2 shows detailed design of the proposed framework. It shows inputs and outputs of every stage along with the notifications sent or received. Grey squares are the main stages. Blue rectangles are planning documents and authorizations while blue rounded rectangles are the notifications and decisions. Oval red boxes are the outputs of the respective stages.The figure is drawn in colour to show better understanding of stages, processes, documents, authorizations, inputs and outputs.

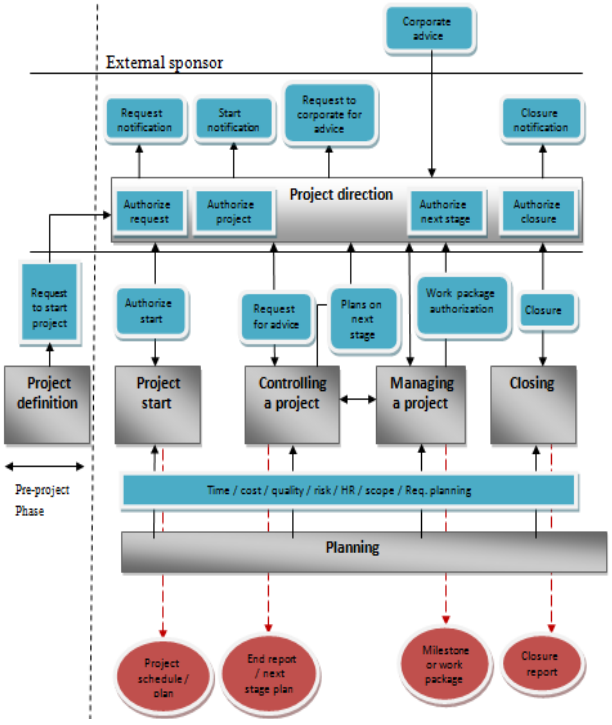

Figure 2 : Detailed Design

i. *Project management / Control*

This stage officially starts and closes a project and continues throughout the project life cycle. This stage also includes project integration management. Therefore, both directing a project (of PRINCE2) and integration management (of PMBOK) are involved. While directing a project tells how to carry out a project, project integration management helps in coordinating other areas to work together throughout. It also handles and manages any change in project's plan or scope through integrated change control.

ii. *Project Definition*

This stage is a pre-project phase. All the activities that are part of pre-project are carried out during this phase. Project's environment is also decided. A project brief or definition outlining what a project will accomplish is prepared. In addition, justification of business importance is also prepared.

iii. *Project Start*

This stage formally starts a project. A project start notification starts it. It includes agreement on all the planning documents including quality and time management. In addition, a business case and how the project will be carried out are developed. Quantitative project management is also a part of this stage, which includes managing quality, performing quality control and check and confirms quality assurance. Authorization of project team members and manager is also part of this stage.

iv. *Controlling a Project*

This stage includes all the major planning on the project. In addition, it also plans on the next stage. Project's scope and requirements management are catered for during this stage. Risk and human resource planning is also discussed. It is during this stage that guidance and decisions on on-going project's activities are asked from the external management, and then scope of project is accordingly adjusted. Integrated project management is used for this purpose.

v. *Managing a Project*

This stage formally starts the execution of project. All the team members start their work against the assigned tasks. Proper communication with all the staff and team members is critical for project success, so, project schedule is carefully rotated among them. Project communication is used for this purpose. While the project is in execution phase, monitoring and controlling is also started to ensure that project is going as planned. Performance analysis is also carried out. This creates a feedback, which is used for necessary improvements or scope changes through integrated change control.

vi. *Planning*

The planning stage continues throughout the project providing guidance on time, cost, quality, risk, human resource, communications and procurement plans. Communication plan includes managing interaction among the stakeholders and team members while procurement plan includes appointing and contracting the suppliers. PMBOK's procurement management provides guidance on this.

vii. *Closing a Project*

This stage officially closes a project. It includes reviewing project's completion according to the project plan. Output is a project closure report, which is authorized by the project board or officials and a closure notification is issued.

d) Flow Diagram

The flow diagram shows systematic description of the design. Square boxes are the main stages of the design while arrows show flow of information. Diamonds boxes are the decisions. Planning phase is not shown in the flow as it continues throughout the project life cycle. Fig.3 below shows the flow diagram.

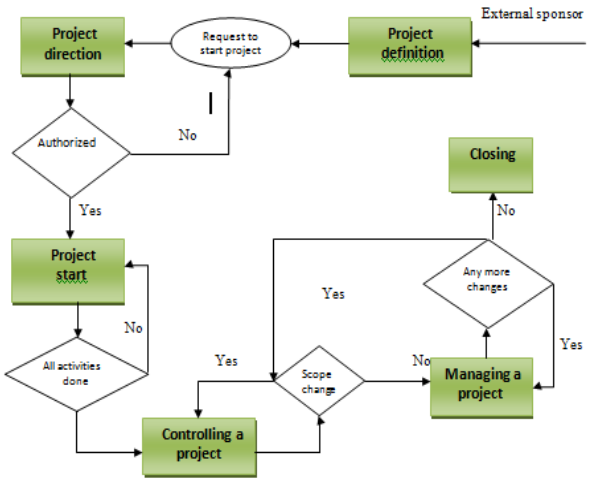

Figure 3 : Flow Diagram

e) Context Diagram

The context diagram shows a single process (stage) of project direction and its relationship with the entities.These entities are always external to a project. This single stage generalizes the function of complete design in relation to the entities. These are the factors from which inputs and outputs come and go. Arrows show flow of inputs/outputs. Corporate management entity is responsible for handling all the matters related to project start, closure, proceedings etc. External sponsorship is funding to project from outside. Stakeholders are people who directly or indirectly have any kind of stake in project. They are affected by all the factors important to the project. Contractors or suppliers are the people who have interest in buying the project once it is complete. System environment is the environment where the project will be tested and evaluated. These entities provide input to project and then receive output. The I/O depends on the nature and

type of entity. For example, the corporate management entity would ask for overall progress of project etc. Fig.4 below shows the context diagram.

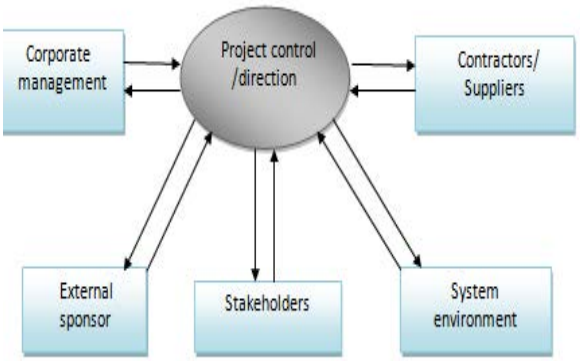

Figure 4 : Context Diagram

VIII. Evaluation of PRICM

PRICM's framework aims at increasing efficiency and reducing weaknesses. PRICM's framework incorporates all the possible benefits including afore mentioned benefits. These include flexibility by allowing maximum communication among all the stakeholders, reduced time and cost, maintaining the scope of the project as stated and the benefit of adaptability.

a) Quality of PRICM

Too much flexibility in a method can lead to over running the requirements stated. This in turn can affect the products produced. Therefore, the strict and product-based nature of PRINCE2 can lead to the desired outcomes. CMMI provides the discipline for carrying out the project while PMBOK provides the knowledge. The project management proven framework of PRINCE2 ensures quality.

b) Efficiency of PRICM

The main benefits as stated earlier provided by the framework are reduced time, cost, and flexibility. Moreover, the interface is simpler as focus is on working and efficiency of the framework. The strengths combined enhance the efficiency and performance. This way the resulting framework will deliver better results up to the expectations of the customers.

c) Assessment of PRICM

Jeff et al. [13] study shows an outcome of improved performance. It also claims increase in productivity and a better quality as compare to traditional methods. Taher et al. [11] study also claims that the framework is applicable wherever required but keeping in view the specifics of the project. Research indicates that framework itself is explanatory providing benefits. However, Zaidoun [8] study concludes with an improved customer relationship. It also shows project remains within time, budget and quality constraints.

PRICM's model is expected to show an increase in performance, better productivity, flexibility, quality improvement and adaptable to any environment. As it includes flexibility and best practices, expectation is it will provide maximum positive results and an improved performance.

d) Applications of PRICM

The proposed framework will be applicable to any working environment. An industry, whether it is software or an IT will benefit from this combination. In addition, it is applicable to smaller projects as well that cannot use heavy frameworks to start with.

IX. Results

This section describes overall results based on evaluation of framework. Tables 1 and 2 below show various parameters related to proposed framework. These show evaluation of framework in context of these parameters. These parameters were selected keeping in view various factors against which to evaluate the framework.

Table 1

Parameter	Support (%)
Quality	90
Productivity	85
Performance	85
Flexibility	95
Discipline	95
Efficiency	85
Time/Budget constraints	85
Results	90

Table 2

Parameter	Support (%)
Applications	85
Level of communication/customer relationship	90
Interface	90
Innovation / Creativity	90
Requirements handling	90
Scope changes handling	90

The above support percent is based on feedback from different people. The participants were given framework to study it and then rate it on a scale from one to five. The percentage is related to the corresponding scale ratings. The tables show improved results as compared to previous counterparts of framework. Overall feedback shows 88.92% results. Table 3 below shows rating of framework and in the category, it falls.

Table 3

Scale	Percentage	Description
5	90 and +	Outstanding
4.5	80 and +	Excellent
4	70 and +	Very good
3.5	60 and +	Much acceptable / good
3	50 and +	Acceptable
2.5	40 and +	Average
2	30 and +	Below average
1.5	20 and +	Should improve
1	10 and +	Must improve / poor

According to the rating scale above, the proposed framework falls in the category of being excellent. Hence concluded, this framework has almost all the qualities and features required by people, experts and professionals. In addition, it has a great level of support for the domain it is made. Moreover, the outstanding category can be achieved with some more enhancements based on participants feedback.

a) PRICM vs. other Frameworks

Zaidoun's research [8] combines project management's method PRINCE2 with agile method XP. He incorporates XP's flexibility in PRINCE2's rigid and strict methodology while making use of PRINCE2's defined framework. The resulting product was a newer version of XP having management's best practices.

Jerzy et al. [9] also suggests integrating PRINCE2 with XP while keeping a balance between agility and discipline. Research indicates that by integrating these methodologies while using appropriate tools results in a much better working framework. [10] claims integrating PRINCE2 with DSDM. It suggests a new management framework by making use of PRINCE2's control and DSDM's agility. However, it has little to no industrial applications.

Ana et al. [5] point seems to be that CMMI's integration with SCRUM works well for small teams and for organizations who wish to move towards agility. Carsten et al. [6] suggests the same combination but argues that SCRUM when integrated with CMMI can handle projects of increasing size and complexity.

However, Lina et al. [7] claims combining it for small and medium sized organizations. Jeff et al. [13] research claims that combination of CMMI and SCRUM can work wonders for any type of company and organization. Research indicates that combination satisfies customer's needs of changing requirements and on time delivery by incorporating CMMI's process discipline and SCRUM's flexibility.

However, the aim of Felipe et al. [12] study is to make a maturity model for agile methodologies based on CMMI's model. It uses process improvement approach from CMMI for software development organizations.

Taher et al. [11] investigate the idea of assessing and integrating CMMI with PMM. Research proposes an enhanced framework that improves efficiency and effectiveness of a project. While these studies suggest integration of CMMI or PRINCE2 with different agile methods, PRICM is a combination of CMMI and PRINCE2 using tools, skills, knowledge and techniques from PMBOK. The result is a synthesized framework for project management that uses best practices and delivers the best possible results. The framework incorporates flexibility along with the strictness for discipline.

Tables 4 and 5 below show nine main studies closest to the research. Only five parameters are shown for comparison as they cover all the remaining parameters.

Table 4

Parameters/ Frameworks	Zaidoun	Jerzy et al	Mike et al	Ana et al
Quality	Yes	Yes	Yes	Yes
Performance	Yes	Yes	Yes	Yes
Time/budget constraints	Yes	Partially	Partially	Partially
Innovation/ creativity	Partially	Partially	Yes	Yes
Scope/ requirements handling	Partially	Partially	Partially	Partially

Table 5

Parameters /Frameworks	Carsten et al	Lina et al	Jeff et al	Felipe et al	Taher et al
Quality	Yes	Partially	Partially	Yes	Yes
Performance	Yes	Yes	Yes	Yes	Yes
Time/budget constraints	Partially	Partially	Yes	Partially	Yes
Innovation/ creativity	Yes	Partially	Partially	Yes	Yes
Scope/ requirements handling	Partially	Partially	Yes	Partially	Partially

The tables show that these frameworks have the required qualities and support, however, not all of them. Performance of all the frameworks is up to the expectations but certain factors, like, scope changes and time or budget constraints are not catered for well. Therefore, the proposed framework PRICM aims to cover up all these factors as much possible and be up to the expectations of professionals and experts.

X. Conclusion

This paper presented a proposed framework for project management. The framework integrated three main technologies namely CMMI, PRINCE2 and PMBOK. The already available framework of PRINCE2 was helpful in making it while PMBOK provided necessary tools and techniques for guiding the implementation. Results show a significant improvement in overall performance and quality of framework as compare to already available frameworks. It aims at implementing almost all types of projects in different environments.

Future research on this topic can include integrating the same framework with other project management models as well expanding the domain of its applications.

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Fuzzy Cognitive Map based Prediction Tool for Schedule Overrun

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Abstract- The main aim of any software development organizations is to finish the project within acceptable or customary schedule and budget. Software schedule overrun is one of a question that needs more concentration. Schedule overrun may affect the whole project success like cost, quality and increases risks. Schedule overrun can be reason of project failure. In today's competitive world, controlling the schedule slippage of software project development is a challenging task. Effective handling of schedule is an essential need for any software project organization. The main tasks for software development estimation are determining the effort, cost and schedule of developing the project under consideration. Underestimation of project done knowingly just to win contract results into loses and also the poor quality project. So, precise schedule prediction leads to efficient control of time and budget during software development. In this paper, we developed a new technique for the prediction of schedule overrun. This paper also presents the comparison with other algorithms of schedule estimation and Tool developed by us and at last proved that Fuzzy cognitive map based prediction tool gives more accurate results than other training algorithms.

Index Terms: *FCM, CCM, PERTBN, fuzzy.*

GJCST-C Classification: *I.2.3*

Strictly as per the compliance and regulations of:

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Atul Kumar [α], Dalwinder Singh Salaria [σ] & Dr. R. C. Gangwar [ρ]

Abstract- The main aim of any software development organizations is to finish the project within acceptable or customary schedule and budget. Software schedule overrun is one of a question that needs more concentration. Schedule overrun may affect the whole project success like cost, quality and increases risks. Schedule overrun can be reason of project failure. In today's competitive world, controlling the schedule slippage of software project development is a challenging task. Effective handling of schedule is an essential need for any software project organization. The main tasks for software development estimation are determining the effort, cost and schedule of developing the project under consideration. Underestimation of project done knowingly just to win contract results into loses and also the poor quality project. So, precise schedule prediction leads to efficient control of time and budget during software development. In this paper, we developed a new technique for the prediction of schedule overrun. This paper also presents the comparison with other algorithms of schedule estimation and Tool developed by us and at last proved that Fuzzy cognitive map based prediction tool gives more accurate results than other training algorithms.

Index Terms: *FCM, CCM, PERTBN, fuzzy.*

I. Introduction

Software schedule plays a vital role in software development. Making a prediction of schedule overrun is a very challenging task. Schedule always get affected by some certain factors: uncertainty, level of detail of preparing the project plan, managerial factors, lack of past data, pressure to lower estimation and estimator experience [18]. Brooks [2] also stated in his well known book in 1975 that assigning more programmers to a project running behind from desired schedule will make the project more lately. The reason behind this is time we have spent upon these programmers to go through from the project as well as the increased communication overhead. There are some reasons that why estimates are not precise like estimating techniques are poorly developed, when there is schedule slippage, software managers tend to increase manpower and makes the project more worst. Likewise, there might be so many reasons behind the schedule overrun. This paper represents the review of some techniques to estimate the schedule as well as various considerations related to future work or we can say it represents the sketch of future plan. We cannot straight that one technique is better in providing high level of accuracy than others. All techniques give different level of accuracy depending on data set taken or parameters chosen.

Some techniques which were used in the past are not in use during present time, like Fuzzy-ECM Approach[8] the way of work time, many of new advance roads have been suggested for effort estimation like Genetic programming, Fuzzy logic, Neural Network, data mining, etc. Most studies dealing with estimation/prediction focus on a single group of factors affecting the accuracy of prediction. So, there is need to develop a Model that provides high level of accuracy. In this paper, Fuzzy cognitive Map based prediction tool has been developed.

II. Review of Literature

Van Genuchten et al., (1991) discussed in paper [18] that why software schedule is overrun, the reasons which are behind it. The purpose of this study to do in-depth research that will easily differentiate between planned project and actual project.

Reichelt et al., (2003) stated that research, design and development projects are not met the required cost and schedule budgets. In this paper [14], author disagree that the tradition tools are the inefficient to predict or estimate the effort regard the project dynamics.

Jun-guang et al., (2011) proposed a systematic method of software project schedule management. This paper [9] comprises with some actual project cases in view of small and middle sized software projects.

Papageorgiou et al., (2011) stated all the recent application and trends on fuzzy cognitive maps in previous ten years. Fuzzy cognitive are inference networks that uses cyclic directed graphs for knowledge representations. They stated in paper [19] that in previous year's fuzzy cognitive map has gained the interest of all the researchers and now a day is widely used to analyze casual systems such as system control, decision making, management, risk analysis, text categorization, prediction etc.

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Elpiniki I., et al., (2013) stated in their survey paper [13] a review of the most up to date applications and trends on the fuzzy cognitive maps. They stated the applications of FCMs (Fuzzy cognitive maps) over the past years.

There are some techniques that are developed by various authors are organized below in systematic manner for the sake of ease is as follows:

a) Program evaluation and Review technique and Bayesian network based

Yong et al., (2011) proposed a technique in paper [26] that is Program Evaluation and Review Technique and Bayesian network (PERTBN) by investigating the popular existing technique Program evaluation and Review Technique (PERT). They built it in two phases. A basic model created first which include the node type and simplifying method of the model. In second phase, PERTBN is go through three process arrangement modes of single-chain, centralized and distributed types. Probability distribution is used as the calculation method by which each node is calculated. So in this way, PERTBN model corresponds with the attribute of DAG, that can managed the schedule management efficiently and effectively optimize the schedule.

b) Fuzzy-ECM approach

Jian-Hong, He, et al., (2011) implemented a new approach that is Fuzzy-ECM Approach. Software development always influences by uncertainty that leads to unexpected results. This leads to face unexpected events like changes in technology, framework and market needs. This paper [8] reveals the existed technology that is ECM (Event Chain Methodology). They investigate the ambiguity nature of activities and events in ECM. So they proposed a new technique that is Fuzzy-ECM (FECM) which is used for estimating schedules of the projects by simulation, simulation, interpolation and sampling.

c) A Simulation-based approach

Lazarova-Molnar et al., (2011) proposed a Simulation-Based Approach. They stated in their paper [11] that project schedules are rigid in nature and often rely on well-planned activities. Each activity has the specific duration. But in real life, projects are often seen stuck in uncertainties. At that time, project definitely leads to re-scheduling and managers need to have some remedial action scenario (RAS) to relief the influence of uncertainty to make the project successful. There is problem which action to take is. To overcome this problem, they propose this approach to enhance project schedules by selection of the optimized RAS when the uncertainty takes place.

d) K2 algorithm based approach

Jeet et al., (2011) stated that main cause of failure of any project is its delay in delivery and the main reason behind this delay is low productivity of software professionals that are throughout works in development process. The purpose of this paper [7] is to identify and manage the factors that influence productivity and hence schedule influences. This model is used to predict the delay in delivery of the project due to these factors in terms of schedule slippage. There are many advantages of this like interdependencies of various risks factors, graphically representation, reduced large volumes of data and prediction of delay.

e) IntelliSPM tool

Stylianou et al., (2012) proposed a novel prototype tool. In this paper [16], they stated that software project managers face a problem a lot, when they going to implement effective staff and schedule of projects. Planning and estimating the execution of tasks plays a key role in projects. When this is not met then projects are delayed in time and/or over budget. Selecting the non-appropriate developers produces lower-quality and defective software products. To overcome these problems, they presents a intelliSPM – a tool that purpose is to support software project managements tasks comprises of may optimization mechanisms which takes from computational Intelligence. The purpose of intelliSPM is to recommend to project managers a set of possible project schedules and staffing strategies. IntelliSPM is found practically beneficial to projects.

f) Object oriented based

Hou, Yonghui et al., (2012) proposed a model in paper [6] that comprises Petri Net Theory with Object – oriented technology. This efficiently solves the possible state explosion problem and the complex systems are modelled by Petri Nets. They used Process Performance Model (PPM) is used to represent past and present software project scheduling controlling performance. They assemble the PPM of software project schedule controlling with OOPN by which clients can direct and organize the whole project schedule more conveniently and intuitively than others.

g) Ant colony optimization based

Xiao, Jing et al., (2013) proposed an approach with the use of ant colony optimization. They stated in paper [18] that Software project scheduling problem (SPSP) is one the active and difficult problem in the current software industry. There are few problem of algorithms exist, with the increasing number of employees and tasks called NP-hard hard Problem. To design an efficient algorithm For SPSP, they introduced an ant colony optimization (ACO) approach which is named as ACS-SPSP algorithm. They compare their algorithm with genetic algorithm. By investigating results, it founds that ACS-SPSP gives better and accurate results compared to genetic algorithm.

h) Based on Earned Schedule Method

Elshaer et al., (2012) proposed a new technique using earned schedule method. In this [3] author examine the recently discovered technique that is EVM

(earned value management). They look into three earned value methods, which are PVM (planed value method), EDM (earned value method) and ESM (earned schedule method). The inspection has shown the results that earned schedule method outperforms on regular as compare to other two methods and a result fails in case of incorrect caution coming from non-critical actions that go through from delays and/or ahead of schedule. The purpose of this paper can be seen as two ways. Firstly, they revise the force of the actions' sensitivity information on the forecasting precision of the earned schedule method. Secondly, they declare the test that in standard environment the indicator of project performance provided by earned schedule method at higher work breakdown structure is trustworthy. More accurately, to improve the schedule performance of a project by removing the harmful effect of wrong warning of the non-critical actions uses activity based sensitivity measures as weighing parameters of the activities.

i) Casual and Cognitive Map based

Al-Shehab., et al., (2005) proposed a method through CCMs (Casual and cognitive maps). They states that due to rapid progressive nature of technology and complication of marketplace, software development have turn out to be more difficult. They proposed an estimation framework for recognizing the reasons of shortfalls in implemented project of information systems. This framework is build with the help of a casual map which is a dependency network diagram representing causes and effects. This casual map modeling is done during the longitudinal case study of a setback project and actual implementation of mapping is portrayed in paper [2].

j) Fuzzy Cognitive based approaches

Giles et al., (2007) proposed a method in their paper [5] using Fuzzy cognitive map to deal with the well known disease 'diabetes' in medical science. They found that the previous methods to the treatment of diabetes are not good because they often fail to recognize indigenous locally on the informal determinants of the diabetes. To overcome this limitation, they found there is not a technique that is able to define these points of view experimentally.

Zhai., et al., (2009) proposed a method with fuzzy cognitive maps that examine the problem of credit risk evaluation of particular companies. At last, they present the working and simulation of the credit risk evaluation of particular companies using Fuzzy cognitive map. In the first section, they found and describe the parameters that are responsible for the cried risk of the particular companies based on qualitative criteria. In second section, they describe how to implement the model. In the last section, the testing procedure is applied on the proposed model. This work is done with the help of AHL (Active hebbian Learning) algorithm based on 96 samples. They also prove the effectiveness of the Fuzzy cognitive map based model for appraising credit risk of particular companies [27].

Giabbanelli., et al., (2012) proposed a fuzzy cognitive map based technique for the diagnosis of obesity based on physiological behavior. In this paper [4], firstly they survey that obesity or also can say overweight found in the two thirds of the American and this continuously going to increases. Doctors face difficulties in solving the tough problem of obesity because the factors are in interdependent to each other. In their paper, model represents the existence of relationship on which factors relies comes with thorough survey. The strength of these dependencies was estimated by team experts. The expert estimations were transformed to values that used by their model by different methods. They made test cases that are defined as rules that show the little depiction of the patients' cases can be used for the identification. These depictions could be acquired by filling a survey form or questionnaire before the appointment with doctor. This helps in guidance for probable behavioral change. All this helps in fuzzy cognitive technique for the prediction.

Salmeron., et al., (2010) implemented a technique in his paper [14] that is of fuzzy cognitive map based technique. They stated that fuzzy cognitive map is an inventive technique of soft computing. They examined the IT projects execution risks and the dependency between the relationships using the fuzzy cognitive map. They surveyed that companies of software projects spend billion of money in IT projects. That's why, IT risk management is found to be a crucial problem. They said that by this proposal, it is achievable to examine which the most pertinent risks are or can say that which have the strong impact on IT projects.

III. Introduction to Fuzzy Cognitive Map

A Fuzzy Cognitive Map (FCM) was first introduced by Kosko[10] as a modelling approach. Dickerson and Kosko used the Fuzzy cognitive map to model how sharks and fish hunt in a virtual world. Fuzzy cognitive map is graphical representations of the relationships between events of the system [12]. Fuzzy cognitive map is defined as "Fuzzy cognitive maps (FCMs) show how causal concepts affect one another to some degree. Causal concepts in virtual worlds include events, values, moods, trends, or goals, etc". A fuzzy cognitive map is the way by which we see the interdependencies between the relations between the elements (concepts, events, project resources) and is used to compute the "strength of impact" of these factors or say elements.

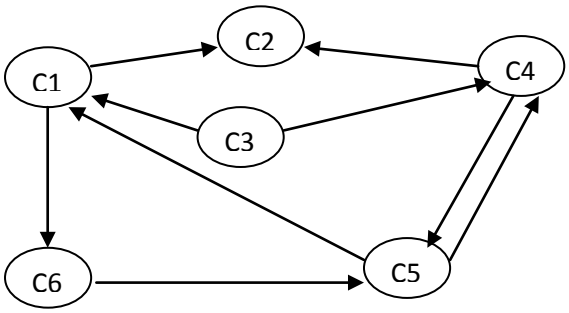

Figure 1 : Representation of basic Fuzzy cognitive map.

In Figure 1, each node in FCM represents a concept. Each arc (Ci, Cj) is directed as well as weighted, and represents causal link between concepts, showing how concept Ci causes concept Cj. Moreover, FCM are efficient in solving the problems like Classification, Prediction, Knowledge representation, Decision making, Modeling, Controlling etc.

The main advantages of Fuzzy cognitive map [18] that motivate us to use Fuzzy cognitive approach are like easy to construct and parameterize, flexible in representation of complex structures, easy to use, easily understandable to non-technical persons or can say higher transparency, able to handle complex issues related to management and knowledge elicitation, handle dynamic effects due to the feedback structure of the modeled system, dependency of the concepts.

IV. Problem Statement

Precise estimation of project duration and schedule management becomes an issue of prime importance because many projects are terminated when it becomes obvious that they will notably go beyond their planned time and budget goals. In today's rapidly growing world, achievement in managing projects is a crucial factor for the success of the entire organization. Estimation that either overestimated or underestimated both is very essential. In case of Overestimating time and effort, due to a presumed lack of resources or because the projected completion is too late, can influence management not to approve projects that may otherwise contribute to the organization. On the other hand, underestimation may result in approval of projects that will fail to deliver the expected product within the time and budget available. In spite of the critical role of accuracy, examples of incorrect estimation abound, especially in IT projects, resulting in enormous waste of time and money. As discussed in introductory part most studies dealing with estimation errors focus on a single group of factors affecting the accuracy of estimation. So, there is need to develop a Model that provides high level of accuracy and improved prediction of results. An important aspect of software development is made project delivery in time. Most of time whole project reaches to the point of failure of the project as the schedule overrun. This is the reason of estimating development effort in central to the management and control of a software project. One of the mind striking question that needs to be asked of any estimation method is how accurate are the predictions. And the exact prediction leads us to the successful projects. There is plenty of estimation models exist for schedule prediction. However, there is a need for novel model to obtain more accurate estimations. There are various models with their own advantages and also limitations. We cannot state that one approach gives better to another. I will develop a mathematical model with increased accuracy to estimate Software Effort. The model will be developed with the help of MATLAB. I will create the Fuzzy Inferences in MATLAB to calculate the weights of the Fuzzy cognitive Map.

V. Proposed Methodology

a) Choosing Parameters

The parameters I choose are responsible for the project's schedule overrun. These factors are used to make the Fuzzy cognitive map of my technique by which we can see the interdependency between the factors in a graphical representation easily.

The factors that are responsible to project's schedule overrun are as follows:

1. Insufficient budgets
2. Lack of management support
3. Lack of management skills
4. Unqualified staff
5. Lack of project control
6. Staff turnover
7. Coding process quality
8. Poor outcome
9. Coding complexity
10. Coding method
11. Unstructured design
12. Wrong design
13. Design complexity
14. New technology
15. Poor documentation
16. Undefined project objectives

b) Data Gathering

I made this survey form by taking various factors which affects the schedule in software development. This survey form has been sent to various multinational companies for response. This data will help me to make inferences in development phase.

After taking the responses from experts, I tested the consistency of the responses by applying Mann-Whitney test.

The Fuzzy inference System is calculated with the help of Fuzzy Editor of MATLAB. There are total 36 rules are generated in the process of fuzzification. These calculated Fuzzy Inference System (FIS) values as shown in Table 1 below.

c) Tool Generation

For the prediction of schedule, tool is generated with the help of MATLAB (Matrix Laboratory R2012A). This has been shown in Figure 2. MATLAB (R2012A) Matrix Laboratory environment is one such facility which lends a high performance language for technical computing. As Fuzzy cognitive map algorithm is used, so this algorithm is integrated with this GUI (Graphical User Interface) for graphical convenience as shown in figure below.

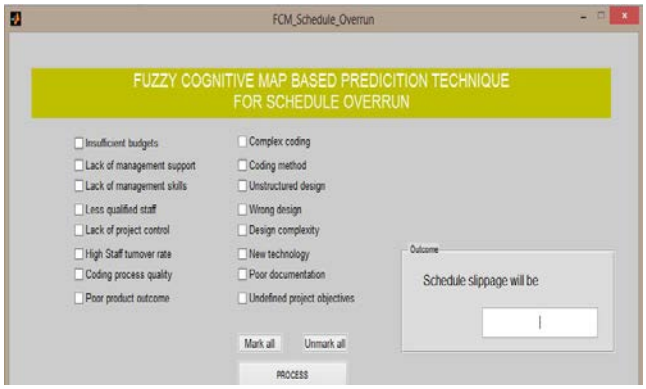

Figure 2 : Fuzzy Cognitive Map based Prediction tool

Table 1 : Sample Survey with corresponding computed FIS values

INPUT FACTOR	OUTPUT FACTOR	LEVEL OF IMPACT (VL/L/N/H/VH)			FIS values
Insufficient budget	Less qualified staff	H	VH	H	0.765
Unqualified staff	Poor Product outcome	H	N	H	0.659
Lack of management support	Lack of project control	N	L	N	0.409
Lack of project control	Poor product outcome	N	N	H	0.591
Lack of management skills	Lack of project control	N	N	H	0.591
Staff turnover rate	Coding Process quality	H	H	N	0.659
Coding Method	Coding Process quality	N	L	N	0.409
Coding method	Design Complexity	N	L	N	0.409
Design complexity	Coding complexity	N	N	H	0.591
Undefined project objectives	Wrong design	VH	H	H	0.765
Poor documentation	Unstructured design	H	VH	H	0.765
New Technology	Unstructured design	L	L	VL	0.235
Unstructured design	Poor outcome	N	N	H	0.591
Poor Outcome	Schedule overrun	H	VH	H	0.765
Low Coding Process	Schedule overrun	N	L	N	0.409
Complex coding	Schedule overrun	N	N	N	0.5
Wrong design	Schedule overrun	VH	H	VH	0.809
High staff turnover rate	Schedule overrun	H	VH	H	0.765

VI. Experimental Results

We supposed the various combinations that if during the development process some factors which affect the schedule of the software project then what would be the possibility of the schedule slippage. These various combinations are shown in table 2.

In case 1, we considered that IF High staff turnover rate, Lack of management support and Wrong design and complex coding are on. The tool predicts the schedule based upon the weights assign to each factor. The following diagram shows the different ON factors and the output panels shows the chances of schedule slippage would be 4.243 months.

In case 2, we considered that IF High staff turnover rate, Lack of management support and Wrong design are on. The tool predicts the schedule based upon the weights assign to each factor. The following diagram shows the different ON factors and the output panels shows the chances of schedule slippage would be 3.1566 months.

In case 3, we considered only one factor that is insufficient budget is on. The tool predicts the schedule based upon the weights assign to each factor. The following diagram shows the ON factor and the output panel shows the chances of schedule slippage would be 3.167 months.

In case 4, we considered that IF Less qualified staff and complex coding are on. The tool predicts the schedule based upon the weights assign to each factor. The following diagram shows the different ON factors

and the output panels shows the chances of schedule slippage would be 2.3094 months.

In case 5, we considered that IF Less qualified staff, complex coding and undefined project objectives are on. The tool predicts the schedule based upon the weights assign to each factor. The following diagram shows the different ON factors and the output panels shows the chances of schedule slippage would be 3.1566 months.

In case 6, we considered that IF High staff turnover rate, Lack of management support and Wrong design are on. The tool predicts the schedule based upon the weights assign to each factor. The following diagram shows the different ON factors and the output panels shows the chances of schedule slippage would be 3.1566 months.

In case 7, we considered that IF High staff turnover rate, Lack of management support and Wrong design and complex coding are on. The tool predicts the schedule based upon the weights assign to each factor. The following diagram shows the different ON factors and the output panels shows the chances of schedule slippage would be 4.243 months.

Table 2 : Summary of all calculated Cases in tabular form.

Sr. No:	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Average expected	Average expected in months	Schedule slippage in months
1.	Insufficient Budget	Undefined project objectives				23.67%	2.84	2.67
2.	Insufficient Budget	Undefined project objectives	Complex coding			26.67%	3.20	3.17
3.	Insufficient Budget					15%	1.81	1.80
4.	Less qualified staff	Complex coding				19.67%	2.36	2.31
5.	Less qualified staff	Complex coding	Undefined project objectives			27.34%	3.28	3.16
6.	High staff turnover rate	Lack of management support	Wrong design			30.34%	3.64	3.78
7.	High staff turnover rate	Lack of management support	Wrong design	Complex coding		36%	4.32	4.24
8.	Lack of management skills	Less qualified staff	Lack of project control	High staff turnover rate	New technology	29.67%	3.56	3.08

VII. Comparison

In paper [7], for inputs Reliance on key personnel as probable, Immature Technology as Frequent, Lack of Client Support as Occasional and Lack of Contact Person Competence as Remote, the Schedule slippage is computed as 6.53061 months.

In the proposed tool, we select input values as Lack of Management Skills, Less qualified Staff, Lack of Project Control, High Staff Turnover Rate and New Technology. These inputs have been selected with a thorough study of input parameters. The reason behind the choice of these input parameters is that the first three input parameters viz. Reliance on key personnel, Immature Technology, Lack of Client Support have values Probable, Frequent and Occasional respectively which when defuzzified acquire more than 50% probability of occurrence whereas the final input parameter namely Lack of Contact Person Competence having value Remote is translated as less than 50% probability of occurrence. We selected our input parameters corresponding to the inputs with high occurrence probability.

Table 3 : Comparison of proposed, actual and existed technique in terms of months

Schedule slippage	Proposed	Actual	Existed technique
In months	3.08	3.56	6.53

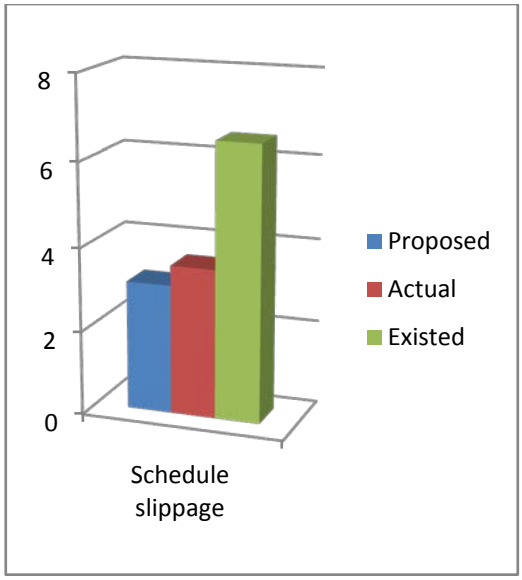

Figure 3 : Comparison of actual, proposed and existing techniques with the help of column chart

Thus, the proposed tool outperforms the tool given by [7]. We compute %age error for both the techniques for more comparison as shown in figure III. This is the formula for "Percentage Error":

$|\text{Predicted Value} - \text{Exact Value}|/|\text{Exact Value}| \times 100\%$

For tool by [7],

$$\text{Error \%age} = (|6.53061 - 3.56|)*100/3.56 = 83.44\%$$

For proposed technique,

$$\text{Error \%age} = (|3.0779 - 3.56|)*100/3.56 = 13.54\%$$

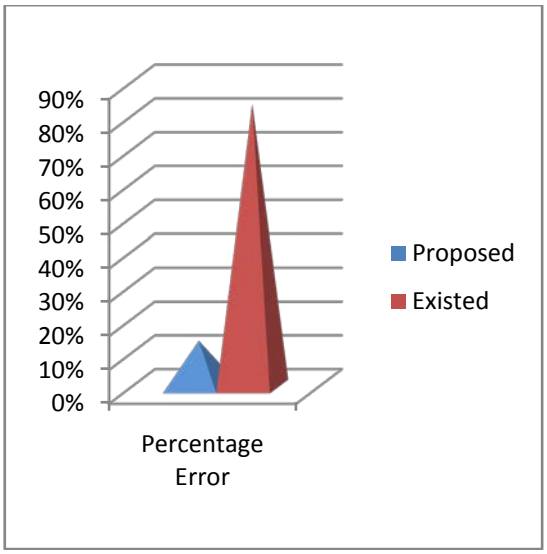

Figure 4 : Graphical representation of percentage error of proposed and existed techniques.

VIII. Conclusion

Software schedule management is one of the most important tasks for the development of failure free projects. To develop the software project failure free, it should be highly preferred for the accurate prediction of cost and schedule overrun. Most studies dealing with estimation/prediction focus on a single group of factors affecting the accuracy of prediction. So, there is need to develop a Model that provides high level of accuracy. Fuzzy cognitive map (FCM) based prediction tool for schedule overrun is developed using MATLAB. Many of new advance roads have been suggested for Schedule estimation and there could be more investigation takes place regarding the improvement of schedule prediction.

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Before start writing a good quality Computer Science Research Paper, let us first understand what is Computer Science Research Paper? So, Computer Science Research Paper is the paper which is written by professionals or scientists who are associated to Computer Science and Information Technology, or doing research study in these areas. If you are novel to this field then you can consult about this field from your supervisor or guide.

TECHNIQUES FOR WRITING A GOOD QUALITY RESEARCH PAPER:

1. Choosing the topic: In most cases, the topic is searched by the interest of author but it can be also suggested by the guides. You can have several topics and then you can judge that in which topic or subject you are finding yourself most comfortable. This can be done by asking several questions to yourself, like Will I be able to carry our search in this area? Will I find all necessary recourses to accomplish the search? Will I be able to find all information in this field area? If the answer of these types of questions will be "Yes" then you can choose that topic. In most of the cases, you may have to conduct the surveys and have to visit several places because this field is related to Computer Science and Information Technology. Also, you may have to do a lot of work to find all rise and falls regarding the various data of that subject. Sometimes, detailed information plays a vital role, instead of short information.

2. Evaluators are human: First thing to remember that evaluators are also human being. They are not only meant for rejecting a paper. They are here to evaluate your paper. So, present your Best.

3. Think Like Evaluators: If you are in a confusion or getting demotivated that your paper will be accepted by evaluators or not, then think and try to evaluate your paper like an Evaluator. Try to understand that what an evaluator wants in your research paper and automatically you will have your answer.

4. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

5. Ask your Guides: If you are having any difficulty in your research, then do not hesitate to share your difficulty to your guide (if you have any). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work then ask the supervisor to help you with the alternative. He might also provide you the list of essential readings.

6. Use of computer is recommended: As you are doing research in the field of Computer Science, then this point is quite obvious.

7. Use right software: Always use good quality software packages. If you are not capable to judge good software then you can lose quality of your paper unknowingly. There are various software programs available to help you, which you can get through Internet.

8. Use the Internet for help: An excellent start for your paper can be by using the Google. It is an excellent search engine, where you can have your doubts resolved. You may also read some answers for the frequent question how to write my research paper or find model research paper. From the internet library you can download books. If you have all required books make important reading selecting and analyzing the specified information. Then put together research paper sketch out.

9. Use and get big pictures: Always use encyclopedias, Wikipedia to get pictures so that you can go into the depth.

10. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right! It is a good habit, which helps to not to lose your continuity. You should always use bookmarks while searching on Internet also, which will make your search easier.

11. Revise what you wrote: When you write anything, always read it, summarize it and then finalize it.

12. Make all efforts: Make all efforts to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in introduction, that what is the need of a particular research paper. Polish your work by good skill of writing and always give an evaluator, what he wants.

13. Have backups: When you are going to do any important thing like making research paper, you should always have backup copies of it either in your computer or in paper. This will help you to not to lose any of your important.

14. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several and unnecessary diagrams will degrade the quality of your paper by creating "hotchpotch." So always, try to make and include those diagrams, which are made by your own to improve readability and understandability of your paper.

15. Use of direct quotes: When you do research relevant to literature, history or current affairs then use of quotes become essential but if study is relevant to science then use of quotes is not preferable.

16. Use proper verb tense: Use proper verb tenses in your paper. Use past tense, to present those events that happened. Use present tense to indicate events that are going on. Use future tense to indicate future happening events. Use of improper and wrong tenses will confuse the evaluator. Avoid the sentences that are incomplete.

17. Never use online paper: If you are getting any paper on Internet, then never use it as your research paper because it might be possible that evaluator has already seen it or maybe it is outdated version.

18. Pick a good study spot: To do your research studies always try to pick a spot, which is quiet. Every spot is not for studies. Spot that suits you choose it and proceed further.

19. Know what you know: Always try to know, what you know by making objectives. Else, you will be confused and cannot achieve your target.

20. Use good quality grammar: Always use a good quality grammar and use words that will throw positive impact on evaluator. Use of good quality grammar does not mean to use tough words, that for each word the evaluator has to go through dictionary. Do not start sentence with a conjunction. Do not fragment sentences. Eliminate one-word sentences. Ignore passive voice. Do not ever use a big word when a diminutive one would suffice. Verbs have to be in agreement with their subjects. Prepositions are not expressions to finish sentences with. It is incorrect to ever divide an infinitive. Avoid clichés like the disease. Also, always shun irritating alliteration. Use language that is simple and straight forward. put together a neat summary.

21. Arrangement of information: Each section of the main body should start with an opening sentence and there should be a changeover at the end of the section. Give only valid and powerful arguments to your topic. You may also maintain your arguments with records.

22. Never start in last minute: Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

23. Multitasking in research is not good: Doing several things at the same time proves bad habit in case of research activity. Research is an area, where everything has a particular time slot. Divide your research work in parts and do particular part in particular time slot.

24. Never copy others' work: Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

25. Take proper rest and food: No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

26. Go for seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. Think technically: Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

32. Never oversimplify everything: To add material in your research paper, never go for oversimplification. This will definitely irritate the evaluator. Be more or less specific. Also too, by no means, ever use rhythmic redundancies. Contractions aren't essential and shouldn't be there used. Comparisons are as terrible as clichés. Give up ampersands and abbreviations, and so on. Remove commas, that are, not necessary. Parenthetical words however should be together with this in commas. Understatement is all the time the complete best way to put onward earth-shaking thoughts. Give a detailed literary review.

33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

34. After conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form, which is presented in the guidelines using the template.
- Please note the criterion for grading the final paper by peer-reviewers.

Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.

Writing a research paper is not an easy job no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record keeping are the only means to make straightforward the progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear

· Adhere to recommended page limits

Mistakes to evade

- Insertion a title at the foot of a page with the subsequent text on the next page
- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

In every sections of your document

· Use standard writing style including articles ("a", "the," etc.)

· Keep on paying attention on the research topic of the paper

· Use paragraphs to split each significant point (excluding for the abstract)

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

· Shun use of extra pictures - include only those figures essential to presenting results

Title Page:

Choose a revealing title. It should be short. It should not have non-standard acronyms or abbreviations. It should not exceed two printed lines. It should include the name(s) and address (es) of all authors.

Abstract:

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

Introduction:

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.

- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

Procedures (Methods and Materials):

This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

Methods:

- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

Discussion:

The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described. Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

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Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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