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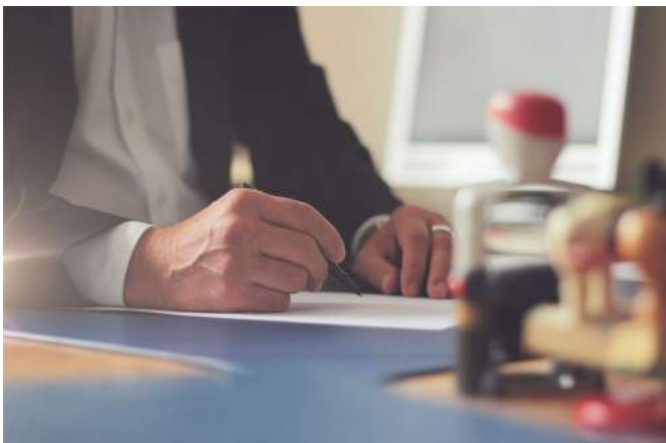
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Improvement of Hybrid Heuristic Algorithm for Solving Capacitated Vehicle Routing Problem

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ABSTRACT

Capacitated Vehicle Routing Problem is the most elementary version of the vehicle routing problem, where it represents a generalization of vehicle routing problems. It is an important problem in the fields of distribution, transportation and logistics which involves finding a set of routes, starting and ends in a warehouse for, that together cover a range of clients. The proposed methodology in this research was based on Cluster-First Route-Second method. There are two proposed hybrid algorithms used to implement that methodology, the Sweep-Nearest Neighbour algorithm and the Sweep-Particle Swarm Optimization algorithm. The Particle Swarm Optimization algorithm was used instead of Nearest Neighbour algorithm to enhance the performance in finding the shortest routes. The two hybrid proposed algorithms were applied in a real case study and the results were compared. From the experimental results, it observed that particle swarm optimization was added more enhancement for finding the best route with the minimum travelling costs.

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Improvement of Hybrid Heuristic Algorithm for Solving Capacitated Vehicle Routing Problem

Mohammed Yaqub

I. ABSTRACT

Capacitated Vehicle Routing Problem is the most elementary version of the vehicle routing problem, where it represents a generalization of vehicle routing problems. It is an important problem in the fields of distribution, transportation and logistics which involves finding a set of routes, starting and ends in a warehouse for, that together cover a range of clients. The proposed methodology in this research was based on Cluster-First Route-Second method. There are two proposed hybrid algorithms used to implement that methodology, the Sweep-Nearest Neighbour algorithm and the Sweep-Particle Swarm Optimization algorithm. The Particle Swarm Optimization algorithm was used instead of Nearest Neighbour algorithm to enhance the performance in finding the shortest routes. The two hybrid proposed algorithms were applied in a real case study and the results were compared. From the experimental results, it observed that particle swarm optimization was added more enhancement for finding the best route with the minimum travelling costs.

Keywords: golden section, sweep algorithm, vehicle routing problem, nearest neighbour algorithm, particle swarm optimization.

II. INTRODUCTION

The Vehicle Routing Problem (VRP) is a very interesting combinatorial optimization problem to study for computer scientists, where it represents a generalized form of the Travelling Salesman Problem (TSP). VRP is the problem of serving a number of customers with a fleet of vehicles, minimizing the travelling cost under several variants. It has applications in the fields of transportation, distribution and logistics. Large package shipping companies benefit greatly from implementing the VRP as efficiently as possible: every percentage saved on transportation costs means saving tremendous amounts of money.

The Capacitated Vehicle Routing Problem (CVRP) is the most common and basic variant of the vehicle routing problem. In this variant, a fixed fleet of a delivery vehicles finding a set of routes with a minimum travelling cost to service the customer demands in different locations [9], where the route is considered feasible if the total demands of all customers on a route does not exceed the vehicle capacity.

The CVRP can be defined on a graph as : G = (V , E), where $V = \{v_0 , v_1 , v_2 , \dots , v_N\}$ are vertices or node set. v_0 represents the depot and the other nodes are N customers that have a certain demand d. The edge set can be represented as $E = \{ (i , j): i , j \in V \}$. The cost $c_{ij} > 0$ is the travelling cost between node i and j, and each vehicle have a capacity Q. The objective is to find a set of routes with the minimum cost (distance) that satisfy the following constraints:

1) Each route start and end at the depot.
2) Each vertex (customer) is visited by exactly one route.
3) The sum of the vertices' demands visited by the route does not exceed the vehicle capacity Q.

The proposed methodology for solving CVRP was based on a heuristic method (Cluster First – Route Second) that composed of two phases:

Clustering phase that used to group customers into clusters and Route generation phase that used to find the best route for each cluster.

The hybrid algorithm that used for solving CVRP was combined Sweep Algorithm (SW) and Nearest Neighbour algorithm (NNA). The SW was used as a clustering technique and then using NNA to find the best route for each cluster. However, using the Nearest Neighbour algorithm in route generation phase was not sufficient enough, probably NNA is easy to implement and executes quickly, but it is sometimes missing shorter routes which are easily noticed with human insight. Therefore, we proposed to use the particle swarm optimization (PSO) as a route generation technique instead of nearest neighbour algorithm to enhance the performance in finding the shortest route for each cluster.

This paper is organized as follows: section 2 presents Related Work for solving CVRP. Section 3 presents Materials and Methods that used in solving CVRP, section 4 presents Results and Discussion, section 5 presents Conclusion, and the paper end with Acknowledgements and References.

III.   RELATED WORK

There are tremendous efforts to improve heuristic and exact methods to solve VRP such in [3], also meta-heuristic and hybrid heuristic methods developed to find the near optimal solution for VRP. A new method that provides a promising result based on particle swarm optimization (PSO) algorithm used to solve CVRP has presented by [6]. In [7], PSO combined with the crossover operation of genetic algorithm (GA), where it applied to single depot CVRP and it can avoid being trapped in a local optimum due to using probability searching. Another solution approach based on PSO presented by [4], in which a local search is performed by a variable neighbourhood descent algorithm (VND), the computational results of that solution indicated that the proposed algorithm produces a better

result that competes with other heuristic approaches.

According to [2], a novel hybrid genetic algorithm (HGA) proposed to solve CVRP, the proposed HGA involves three stages. First, a diverse and well-structured initial chromosome population was constructed. Second, response surface methodology (RSM) experiments were conducted to optimize the crossover and mutation probabilities in performing GA. Finally, a combined heuristic containing improved insertion algorithm and random insertion mutation operator were established to stir over gene permutations and enhance the exploration capability of GA diversely. In [12], Ant Colony Optimization (ACO) with swap and 3-opt heuristic has the capability to tackle the CVRP with satisfactory solution quality and run time, where it represent a viable alternative for solving the CVRP. In that proposed approach, ACO combined with heuristic approaches that act as the route improvement strategies. The proposed ACO utilized a pheromone evaporation procedure of standard ant algorithm in order to introduce an evaporation rate that depends on the solutions found by the artificial ants.

Another proposed method introduced by [5], that combined particle swarm optimization algorithm and Genetic algorithm with crossover and mutation operators for solving capacitated vehicle routing problem with time windows (CVRPTW) efficiently. In [8], a developed PSO algorithm presented for solving CVRP by combined a different heuristic such as Two Optimal Exchange (TOE), Two Optimal Insertion (TOI) and TSP Optimal Exchange (TSPOE), that used to improve the solutions, which lead to enhanced solutions and obtain good results in both small and medium problem instances.

IV.   Materials and Methods

4.1 Methodology

The overall goal of this paper was to use the PSO algorithm instead of NNA to enhance the performance in finding the shortest routes, the

proposed methodology used to solve CVRP based on Cluster-First Route-Second method composed of two main phases, the first phase is to group customers into clusters and the second phase is to find out the optimal solution (best route path) for each cluster. There are two hybrid algorithms used to implement that methodology, first hybrid algorithm is Sweep - Nearest Neighbour Algorithm (SW & NNA), the second hybrid algorithm is Sweep - Particle Swarm Optimization algorithm (SW & PSO), where the Sweep algorithm in both hybrids proposed algorithms was used for clustering phase, and the other algorithm is used for finding the best path for each cluster.

4.2 Sweep Algorithm

Sweep algorithm is one of the simplest heuristic algorithms that have been developed to route vehicles. It firstly proposed by Gillet and Miller in 1974 to find the shortest route in the vehicle routing problem [1]. Sweep algorithm consists of two main stages, the first stage is clustering nodes (customers) into groups, so all nodes in the same group are geographically close together and can be served by the same vehicle, nodes clustered based on their capacity where capacity represents the maximum number of goods that can be carried by vehicle in serving a route. Second stage is the route generation or finding path in each cluster based on different constraints such shortest distance and capacity constraint that repeated to obtain the optimal solution, in our methodology we used sweep algorithm for clustering stage to get the best customers' clusters.

All nodes in sweep algorithm are represented by two-dimensional plane, where the depot is located at the centred of that plane with (0,0) coordinates and 0 demands, then computing the polar coordinates of each node with respect to the depot. The sweep algorithm starts to sweep all nodes by increasing the polar angle, making a list of all nodes' angles where it assigns each node encompassed by the sweep to the current cluster and sweeping is stopped when adding the next node (customer demand) would violate the maximum vehicle capacity. Create a new cluster by resuming the sweep where the last one left off, and repeat assigning steps to each cluster until all nodes have been included in a cluster.
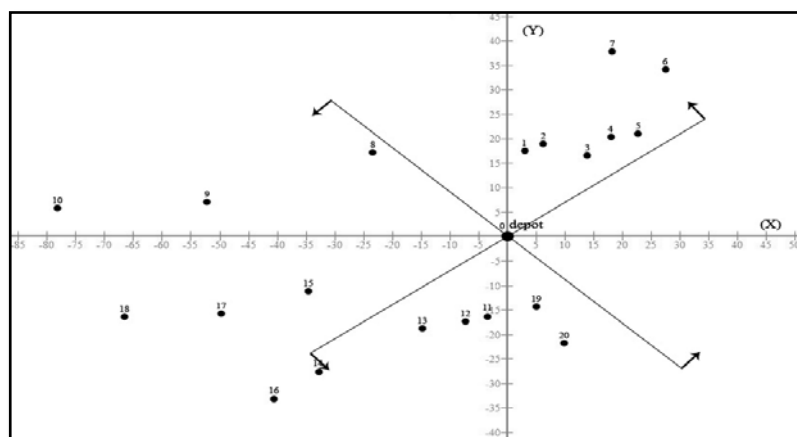
Figure 1: Clustering process for customer nodes

Figure 1 illustrates nodes clustering process where the black dots represent the nodes and the straight lines represent the sweep hand when it moves anti-clockwise.

- A general formula for calculating the polar coordinate:

$$\phi = \tan^{-1}(y/x) \qquad (1)$$

Where

ϕ : angular value of a node (i.e., depot or customer).

x, y : coordinate values in degree.

1. A general formula for calculating the Euclidean distance:

$$d_{ij} = \sqrt{(X_i - X_j)^2 + (Y_i - Y_j)^2} \qquad (2)$$

Where

d_{ij} : distance between two nodes.

X_i : X coordinate value for node i.

X_j : X coordinate value for node j.

Y_i : Y coordinate value for node i.

Y_j : Y coordinate value for node j.

Clustering nodes into groups is established by joining nodes, beginning of the closest node that has the smallest angle. This process is repeated by joining the second closest, the third, and so forth until it satisfies the capacity constraint where the total demands for all nodes in each cluster not exceeding the vehicle capacity. The process is completed when all nodes are included in clusters.

4.3 Nearest Neighbor Algorithm

The route generation phase is aimed to optimize searching method to find the optimal solution that represents the shortest path between all nodes in each cluster. The Nearest Neighbour Algorithm (NNA) is used as a heuristic method to find the shortest path between each cluster nodes as a travelling salesman problem [11]. After nodes being clustered, the NNA is performed to reorder nodes on each cluster based on the distance of one node to another to generate the shortest routes. The distance matrix between all nodes in each cluster are created by using equation 2 for calculating the Euclidean distance. The first node to be linked in each cluster is the one that has the shortest distance to the depot, the next node to be linked is selected by searching a node that is closest to the first node. This procedure is repeated until all nodes in the same cluster are linked as a route. The same procedure is performed for all clusters until all routes are generated.

4.4 Particle Swarm Optimization

Particle swarm optimization was originally introduced by Eberhart and Kennedy in 1995 as an evolutionary computation technique which designed as a self-adaptive search optimization algorithm based on the simulation of the animal social behaviours such as fish schooling and bird flocking, that swarms work in a collaborative manner to search for foods as efficient and quick as possible [10].

In PSO, a solution of a specific problem is being represented (directly or indirectly) by the n-dimensional position of a particle. The search is performed by moving the particle to a new position via a velocity vector. The PSO algorithm starts with a population of particles initialized with random position and velocity. The population of particles is usually called a swarm. In one iteration step, every particle is moved from previous position to the new position based on its velocity. The velocity of a particle is updated based on the particle's personal best position (pBest) and the global best position found so far by the swarm (gBest). This allows the particles to exchange their experience to ensure the diversity of the search and lead to improvement of solutions.

PSO also has a fitness function that takes the particle's position and assigns to it a fitness value. The position with the minimum fitness value in the entire run is called as social or global best. Each particle keeps track of its minimum fitness value, called its cognitive or local best. The velocity of the particle, each of dimensions, is accelerated towards the global best and its own local best. The inertia weight has a well balanced mechanism with the flexibility to enhance and adapt to both global and local exploration abilities. The formula for updating the velocity of each particle in the swarm are as follows.

$$V_{id}(t+1) = W V_{id}(t) + c_1 r_1 (P_{id} - X_{id}) + c_2 r_2 (P_{gd} - X_{id})$$

$$(3)$$

Where

V_{id} : velocity of dimension d of the i th particle.

P_{id} : personal best previous position of the i th Particle.

P_{gd} : the global best position for all particles.

X_{id} : current position of the i th particle.

c_1 & c_2 : are acceleration constants.

r_1, r_2 : random function in the range [0, 1].

W : Inertia weight.

The new velocity calculated in that iteration is used for updating the current position of each particle by using the following formula:

$$X_{id}(t+1) = X_{id}(t) + V_{id}(t+1) \qquad (4)$$

Where

$X_{id}(t)$: current position of the i th particle.

$X_{id}(t+1)$: new position of the i th particle.

$V_{id}(t+1)$: New velocity of the i th particle.

The process of updating the velocity and the position of each particle in the swarm is repeated until it reached a specific number of iterations as a termination criteria or reaching to the same final solution.

4.5 Case Study

Tiba Company for Trade and Distribution is one of Juhayna Group companies that owns 24 distribution centers spread across the majority of the provinces of Egypt, where the distribution network covering 27 provinces, nearly 36,000 retail outlets, through more than 800 car and truck distribution.

Our case study applied in the Tiba Company for Trade and Distribution - Mansoura branch which deliver dairy products from their distribution center to about 850 retail outlets in Mansoura city. The company splits their customers into 3 levels, level-1 represents customers with high demand, level-2 represents customers with medium demand and level-3 represents customers with low demand, we will focus on Level-1 where it services about 20 high demand supermarkets where the company owns a fleet of 4 refrigerated trucks used to serve that level of customers. The objective is to minimize cost by minimizing the total distance travelled and under the following constraints:

1. Each customer is visited exactly once.
2. Each vehicle route starts and ends at the depot.
3. Each customer is serviced by one and only one vehicle.
4. Customers have grouped into clusters and the total customer's demands of each cluster not exceeding the vehicle capacity.
5. Demand at each customer is known.
6. The cost is measured by the total distance of all routes.

Figure 2 shows the case study customers that located on the Mansoura city map.
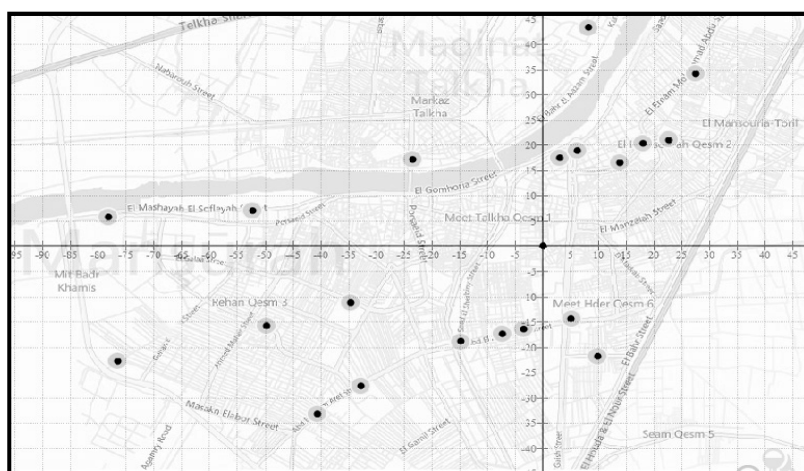
Figure 2: Customers locations on map

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Table 1 shows node name, Cartesian coordinates for each node and demand, which are the required data to apply the clustering process in sweep algorithm.

Table 1: Node name, X, Y coordinates value of each customer and their demands

Node	X Coordinate	Y Coordinate	Demand	Node	X Coordinate	Y Coordinate	Demand
Depot	0	0	--	11	-4	-16	450
1	3	17.5	462	12	-7	-17.5	480
2	6	19	510	13	-15	-19	462
3	14	16.5	606	14	-33	-27.5	510
4	18	20.5	720	15	-34.5	-11	624
5	22.5	21	624	16	-40.5	-33	414
6	27.5	34	450	17	-50	-15.5	510
7	9	43	420	18	-76	-23	582
8	-24	17	750	19	5	-14	612
9	-52	7	810	20	10	-21.5	762
10	-76	9	846				

Input parameters that represent the constraints required to clustering process are presented in table 2.

Table 2: Input parameters

No. of Vehicles	4
Maximum Vehicle capacity	3500 (units)
Total Demand	11604 (units)

V. Results and Discussion

The two proposed approaches that's based on hybrid Sweep-Nearest Neighbour Algorithm (SW & NNA) and hybrid Sweep-Particle Swarm Optimization (SW & PSO) was coded in C# on an Intel Core i3-2350M CPU 230 GHz with 3.00 GB of RAM under Windows 8 platform. After clustering process is performed by using the sweep algorithm, the optimal routes achieved by using a nearest neighbour algorithm in the first hybrid algorithm and in the second hybrid algorithm, the optimal routes achieved by using particle swarm optimization. The resulted clusters and their total travelling distances were compared in table 3.

Table 3: Resulted clusters and the total travelling distances

No.	Sweep & Particle Swarm Optimization (SW&PSO)		Sweep & Nearest Neighbour Algorithm (SW&NNA)	
	Vehicle Route	Total distances travelled	Vehicle Route	Total distances travelled
1	0 , 14 , 13 , 12 , 11 , 20 , 19 , 0	113.28	0 , 19 , 20 , 11 , 12 , 13 , 14 , 0	113.28
2	0 , 15 , 17 , 10 , 18 , 16 , 0	209.2	0 , 15 , 17 , 16 , 18 , 10 , 0	217.68
3	0 , 9 , 8 , 7 , 6 , 2 , 1 , 0	192.11	0 , 1 , 2 , 7 , 6 , 8 , 9 , 0	202.3
4	0 , 5 , 4 , 3 , 0	62.6	0 , 3 , 4 , 5 , 0	62.6
	Total	577.19	Total	595.86

In PSO, the inertia weight is taken as 0.47 and the acceleration constants are set as $c_1 = c_2 = 2$ as proposed in [13].

The optimum routes that resulted from using (SW & PSO) are as bellows:

Vehicle 1# : **0 - 14 - 13 - 12 - 11 - 20 - 19 - 0.**
Vehicle 2# : **0 - 15 - 17 - 10 - 18 - 16 - 0.**
Vehicle 3# : **0 - 9 - 8 - 7 - 6 - 2 - 1 - 0.**
Vehicle 4# : **0 - 5 - 4 - 3 - 0.**

Total travelling distances: **577.19**.

Figure 3 shows the optimal routes by using (SW & PSO) in the graph:
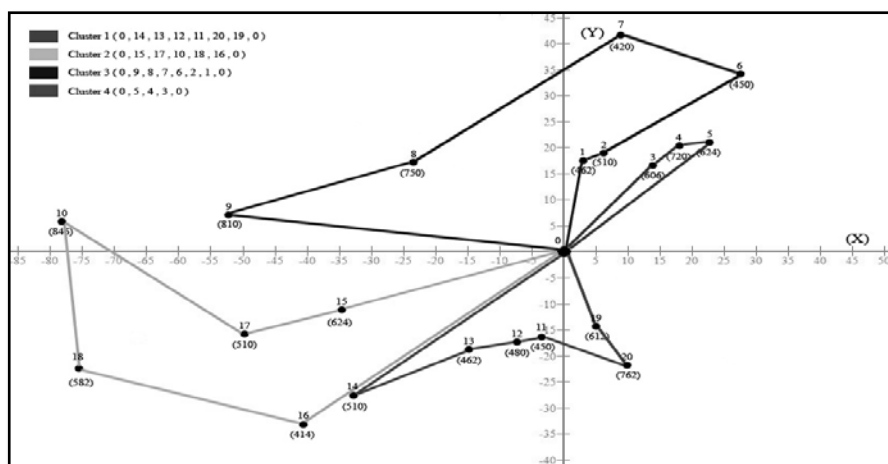
Figure 3: Resulted optimal routes by using (SW & PSO) algorithm

The optimum routes that resulted from using (SW & NNA) are as bellows:

Vehicle 1# : **0 - 19 - 20 - 11 - 12 - 13 - 14 - 0.**

Vehicle 2# : **0 - 15 - 17 - 16 - 18 - 10 - 0.**

Vehicle 3# : **0 - 1 - 2 - 7 - 6 - 8 - 9 - 0.**

Vehicle 4# : **0 - 3 - 4 - 5 - 0.**

Total travelling distances: **595.86**.

Figure 4 shows the optimal routes by using (SW & NNA) in the graph:
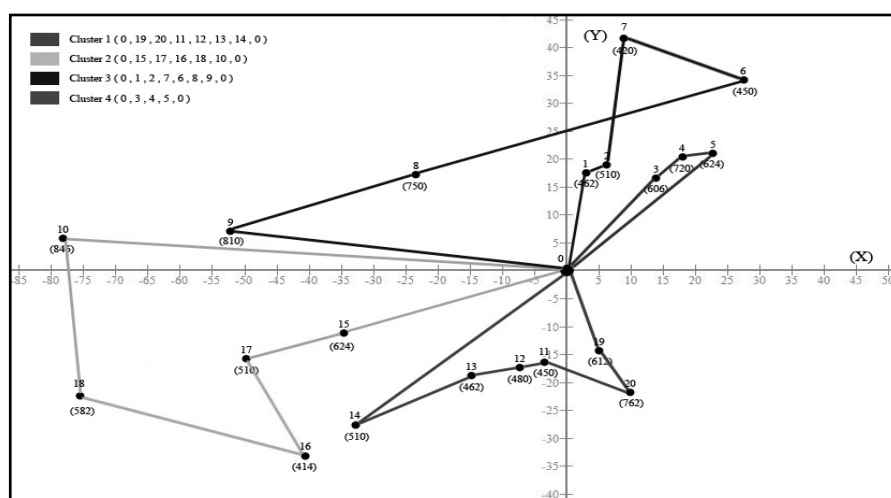
Figure 4: Resulted optimal routes by using (SW & NNA) algorithm

VI. CONCLUSION

In this paper, Cluster-First Route-Second method proposed as a methodology to reduce the total cost of capacitated vehicle routing problem (CVRP), where it's based on grouping customers into clusters and then finding out the shortest path for each cluster. The CVRP was solved by using two hybrid algorithms, the hybrid Sweep-Nearest Neighbour Algorithm (SW & NNA) and the hybrid Sweep-Particle Swarm Algorithm (SW & PSO). This work proposed to group the customers and to find out the optimal path of each group/cluster thereby minimizing the transportation costs. The disadvantage of the nearest neighbour algorithm that it sometimes missing shorter routes which are easily noticed with human insight. Therefore, it replaced by PSO to improve the route generation phase. By consolidating the travelling cost as directionally proportional to total distance travelled by the vehicle. The two hybrid algorithms were compared and from the experimental results, it observed that the total costs (travelling distance) were reduced by using the hybrid SW& PSO. Therefore, the PSO added more enhancement in finding out the best route for each cluster compared to the nearest neighbour algorithm.

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Identifying the Factors Affecting Agile Project Management in IT Sector

Syed Ehsen Mustafa, Dr. Nadeem Ishaque Kureshi

ABSTRACT

It is a common assumption that practicing Agile Project management methodologies will help in successful completion of projects achieving timely delivery and happy stakeholders. The problem is that organizations claim to be following Agile project management methodologies are unable to meet the criteria of practicing agile methodologies and hence fail to achieve the claimed success from agile project management. In this study, we have analyzed three different IT organizations that claim to practice Agile methodologies and studied the factors that are essential for practicing agile project management methodologies. After conducting a quantitative survey, it has been found out that there is a direct relationship between practicing Agile methodologies and self- organizing teams. The questionnaire survey used in this study serves as an evaluation tool that will help any organization [i.e. claiming to practice Agile methodologies] to answer the question that is they really are practicing the agile methodologies and fulfill its criteria. It will help an organization to identify their current standing and improvement areas to get the benefit of practicing Agile project management methodologies.

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Identifying the Factors Affecting Agile Project Management in IT Sector

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I. ABSTRACT

It is a common assumption that practicing Agile Project management methodologies will help in successful completion of projects achieving timely delivery and happy stakeholders. The problem is that organizations claim to be following Agile project management methodologies are unable to meet the criteria of practicing agile methodologies and hence fail to achieve the claimed success from agile project management. In this study, we have analyzed three different IT organizations that claim to practice Agile methodologies and studied the factors that are essential for practicing agile project management methodologies. After conducting a quantitative survey, it has been found out that there is a direct relationship between practicing Agile methodologies and self-organizing teams. The questionnaire survey used in this study serves as an evaluation tool that will help any organization [i.e. claiming to practice Agile methodologies] to answer the question that is they really are practicing the agile methodologies and fulfill its criteria. It will help an organization to identify their current standing and improvement areas to get the benefit of practicing Agile project management methodologies.

II. LITERATURE REVIEW

Project Management is an essential part in Software development Organizations. According to survey VersionOne, Inc (2013), it was observed that many organizations practicing the Agile methodologies in project management, still face delays in schedules or compromise with quality in case of timely delivery. According to survey Scott W. Ambler (2010), failure is mainly due to:

- Agile team's lack of experience with agile methods.
- Agile team's lack of understanding the organizational strategies.

Professionals use Agile Project management to achieve customer satisfaction and to address the fast-changing requirements, as a common practice in project management. So rapid change management can be handled by the usage of Agile project management.

It is the assumption of the software industry that Agile project management ensures incremental and timely delivery of products, especially in case of software projects. But the most important principle of following Agile project management that is not understood is to build a motivated team that is well aware of Agile practices and methodologies. Agile project management ensures involvement of all stakeholders and regular feedbacks from the customer for complete the customer satisfaction. Agile methodologies require the communication among the team, management and customer should be open and effective (i.e it should be ensured that all information from customer is understood by the team and all feedbacks from customer are taken care of, during the product development).

So basically Agile project management requires self-organizing teams having technical excellence,

capable of providing best architectures, design and adaptable to frequently changing technologies to keep aligned with the competitive business requirements. According to our study in this paper effectiveness of agile project management depends on a highly capable and confident Team. Software Projects get delayed or are unable to meet the customer requirements even after using Agile methodologies is mainly due to the reason of not following all the principles of agile project management.

The success of agile project management methods depends on:

- Efficient and Effective team
- Rich communication among all stakeholders.

These two factors help in practicing the agile management processes effectively and help in contributing towards the successful agile software development projects in terms of cost, scope, time and quality as described by Tsun Chow and Dac-Buu Cao (2008).

The Effectiveness of Agile management processes is related to a highly capable team that can help the organization, in completing it projects on time with continuously changing requirements by the customer Ali Rezaeean and Parisa Falaki (2012). According to Ali Rezaeean and Parisa Falaki (2012), effective project management is a core factor that needs to align with organizational business strategy. In today's Business market it's very important to handle the fast-changing business requirement due to the competition as an external factor/constraint that every business needs to handle. To achieve effective Agile project management, one needs a highly capable Team with strong bonding cater these external constraints.

It requires six different roles to make the team self- organizing by practicing in agile project management processes Rashina Hoda (2011). As in Agile project management, it's necessary that:

- The project team understands the agile practices.

- Understand the customer requirements.
- Maintain effective communication with management
- Ensure that stakeholders are satisfied with the ongoing development.
- Ensure all risks hampering the agile project management processes are eliminated as soon as possible with the consent of senior management.

A different point of view is mentioned in M Eccles, J Smith, M Tanner, JP Van Belle and S Van der Watt (2010) about the Team Collocation for Agile project management but that's only true in case team is small. As negative impacts of collocation were identified as a part of M Eccles, J Smith, M Tanner, JP Van Belle and S Van der Watt (2010) research, which correlate Agile effectiveness with culture of the organization, or one may say the environment where a collocation team is working.

The Effectiveness of Agile methodologies is best evaluated where project management is done for Distributed software development (DSD). According to Fabio Q. B. da Silva1, Rafael Prikladnicki 2, A. Cesar C. França1, Cleviton V. F. Monteiro 1, Catarina Costa1 and Rodrigo Rocha1 (2011) Agile project management of DSD is more complex as compared to the collocated project management. As claimed in Fabio Q. B. da Silva1, Rafael Prikladnicki 2, A. Cesar C. França1, Cleviton V. F. Monteiro 1, Catarina Costa1 and Rodrigo Rocha1 (2011) that human factor is of greater importance in case of Distributed project management.

Agile effectiveness is highly dependent on the project management Team (H. Sharp and H. Robinson, 2004), (A. Cockburn and J. Highsmith, 2001). As analyzed studies of (Deepti Mishra and Alok Mishra, 2009) and (H. Sharp and H. Robinson, 2004) that usage of agile project management methodologies directly depends on the Team communication, collaboration and coordination. These factors are essential in achieving the success expected from agile project management and help in ensuring the quality and productivity.

So as discussed in above literature review, it is analyzed that Team Empowerment is the factor that makes agile methodologies effective in a project management. In our research we are going to measure the four cognitions namely meaning, competence, self-determination and impact, which define the team empowerment.

III. RESEARCH METHODOLOGY

In this research, IT organizations that claim to practice Agile project management will be selected, and then we are going to analyze that how empowered Agile practicing teams are, with respect to organization history of agile project management success and failure.

This research would help in identifying the factors that would help the agile practicing organizations in improving their team communication and collaboration concerning to get maximum benefit from agile based project management.

The four factors that will be measured are for identification of a self-organizing team are:

- *Meaning:* This factor determines that a team member's personal beliefs, values, and behaviors are aligned with the type of work assigned to him in organization.

- *Competence:* This factor determines that Team member of an Agile team, believes in successfully completing the challenges of work assigned based on his skills

- *Self-determination:* This factor determines the autonomy of a Team member in terms of adapting to change management related to work. Possessing the ability of decision making to maintain the pace of work without affecting the quality and alignment from organizational strategy

- *Impact:* This factor determines that team member possesses the personality to influence strategic, administrative or operating outcomes during agile project management.

The research questionnaire as given in Dail L Fields book is selected as a part of our study to perform a quantitative study that will serve as a tool to identify that how self-organized are the teams of an Organization, claiming to practice Agile project management. It's a validated tool for measuring the empowerment of employees as used by Menon (1999) to measure the abilities of employees, regarding capability of performing their tasks and alignment to employees behaviors, skills according to the organizational strategy.

In addition to the above measurement tool, we are going to add few more question in our questionnaire to Validate that the organization selected for our research are actually practicing the Agile project management methodologies and how close they are in terms of implementation of agile methodologies.

The questions given in Appendix A Table 1 are extracted from the survey by Scott W.Ambler (2010). These questions help in identifying that the organization claiming to be practicing Agile methodologies are actually following the principles of Agile methodologies. Questions in Appendix A Table 1 are designed based on the criteria of Agile project management as described in Scott W.Ambler (2010) Criteria for Agile Teams. Following is the details of how the designed questions will help in determining the degree an organization is agile in terms of project management.

- Questions 1 to 3 from Table 1 identifies the team give value to stakeholders and ensures stakeholder involvement right from the beginning of the Project management.
- Questions 4 identifies that regular testing procedures are being followed at every iteration of project management as identified by the Agile principles.
- Question 5 ensures that continuous customer / stakeholder feedback is acquired as an agile project management practice.
- Questions 6 and 7 identify that teams follow up with the progress and organize themselves

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according to the needs of a project which refers to the self-organizing team criteria of Agile project management.

- Questions 8 to 10 identify that, are the teams continuously improving their work procedures from the lessons learnt, that refers to the criteria of continual improvement in agile project management.

For Questionnaire reliability we found that Cronbach's Alpha is 0.944 for 22 items using SPSS software.

3.1 Data Collection and Analysis

Having established on the basis of literature review that self-organizing team is compulsory requirement for any agile practicing team in case of software development organizations, we surveyed to find out the is it necessary for a team to be self-organizing to benefit from practicing Agile methodologies.

To conduct our survey, we selected three different organizations that have been practicing agile methodologies for software development. The respondents and organizations were informed before filling the questionnaire that during data gathering process their organization's name and personal identities will not be recorded.

3.2 Sample Size Calculations

Power and Precision was used to calculate sample size utilizing Fisher Z approximation methodology. For computation, it was assumed that the correlation in the population is 0.92. The Criterion for significance (alpha) was set at 0.050. The test was 2-tailed (an effect in either direction is interpreted). We found that study has the power of exceeding 99.9% to yield a statistically significant result, if the sample size is minimum 50. Based on these same parameters and assumptions we can expect to observe a correlation of 0.92 with precision (95.0% confidence level) of approximately plus/minus 0.05 points (Confidence interval of 0.86 to 0.95).

3.3 Data Collection

A total of 50 samples were collected using the questionnaire discussed in above section, also given in Appendix A. In our analysis we have calculated the reliability of 50 samples and performed Pearson correlation calculation to find out the overall relation of teams practicing agile methodologies concerning criteria that teams are self organizing teams.

3.4 Data Analysis

For Data Analysis SPSS tool was used. All 50 samples data was validated, and then we calculated mean and standard deviations which are in Table 1. We confirmed results using Factor Analysis.

Table 1: Descriptive Statistics (N=50 for Each Item)

Question Numbers	Mean	Std. Deviation
1	4.52	1.282
2	5.02	1.407
3	5.00	1.309
4	4.84	1.315
5	5.16	1.315
6	5.38	1.427
7	5.06	1.583
8	4.24	1.492
9	4.42	1.341
10	4.50	.931
11	5.48	1.266
12	5.34	1.099
13	5.40	1.069
14	5.68	1.133
15	5.50	1.093
16	5.20	.990
17	5.26	.803
18	5.16	1.017
19	5.18	.962
20	4.42	1.090
21	4.16	1.057
22	4.22	1.016

Overall items mean is 4.961 (minimum=4.160, maximum=5.680), items variance 1.436, inter-item covariance 0.622 and inter-item

correlations 0.439. Afterwards, Pearson Correlation calculations were carried out for all 50 samples which generated following results as given in Table 2 and Table 3. Q1 to Q22 in column/row refers to a serial number of questions from Appendix A. The numbers on Table are Cronbach's α **P<.01 (i.e., correlation is significant at the 0.01 level (2-tailed), *P<.05.

Table 2 represents the correlation of items (Q1- Q10) that represent the level at which Team is practicing Agile methodologies, with the items (Q11 – Q22) that represents the level of team called as Self-organizing team.

Similarly, Table 3 represents the inter-item correlation of Q11-Q22 which defines the teams, as self-organizing teams and here we find a correlation of four attributes of self-organizing teams (i.e. Meaning, Competence, Self-determination and Impact).

Table 2: Bi-Variate Pearson Correlations 1 (Test of Significance. 2 Tailed, N=50)

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Q11	.283*	.533**	.480**	.501**	.591**	.564**	.566**	.186	.143	.225
Q12	.437**	.471**	.510**	.547**	.583**	.436**	.422**	.248	.123	.269
Q13	.411**	.510**	.569**	.555**	.636**	.487**	.432**	.335*	.194	.205
Q14	.482**	.772**	.757**	.718**	.720**	.758**	.489**	.445**	.332*	.368**
Q15	.466**	.724**	.642**	.653**	.625**	.740**	.395**	.375**	.299*	.431**
Q16	.512**	.510**	.425**	.480**	.367**	.480**	.175	.409**	.274	.266
Q17	.342*	.447**	.388**	.407**	.308*	.375**	.276	.253	.200	.286*
Q18	.420**	.682**	.705**	.614**	.453**	.576**	.336*	.310*	.309*	.280*
Q19	.402**	.525**	.567**	.588**	.428**	.440**	.194	.055	.067	.307*
Q20	.586**	.447**	.515**	.447**	.451**	.486**	.186	.351*	.226	.231
Q21	.435**	.314*	.354*	.268	.363**	.297*	.250	.532**	.369**	.228
Q22	.443**	.225	.353*	.317*	.386**	.293*	.144	.422**	.275	.313*

Table 3: Bi-Variate Pearson Correlations 2 (Test of Significance. 2 Tailed, N=50)

	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22
Q11	1											
Q12	.702**	1										
Q13	.700**	.906**	1									
Q14	.622**	.679**	.664**	1								
Q15	.472**	.535**	.559**	.758**	1							
Q16	.264	.443**	.424**	.550**	.604**	1						
Q17	.156	.337*	.375**	.385**	.407**	.164	1					
Q18	.320*	.279*	.372**	.559**	.496**	.373**	.472**	1				
Q19	.330*	.443**	.444**	.559**	.476**	.390**	.572**	.679**	1			
Q20	.265	.304*	.396**	.541**	.489**	.431**	.479**	.490**	.491**	1		
Q21	.369**	.409**	.520**	.453**	.371**	.359*	.359*	.279*	.192	.685**	1	
Q22	.376**	.498**	.556**	.506**	.395**	.300*	.404**	.222	.293*	.726**	.841**	1

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IV. DISCUSSIONS

Observation from the calculation of mean:

- It is evident from the overall mean of 4.961 that to practice Agile methodologies the teams have to become self-organizing team.
- In case the team is not self-organizing then it means it will not be able to practice Agile methodologies and get benefit out of it.
- Q8, Q9, Q20, Q21 and Q22 show minimums values of mean (i.e. 4.24, 4.42, 4.42, 4.16 and 4.22 respectively) out of all question items.
- It shows two major areas of concern about criteria of "continual process improvement" required for the agile project management and "attribute of Impact" that's required for self organizing team practicing agile project management.

Observation on Cronbach's alpha if Item deleted:

- Out of twenty-two, four items Q2, Q3, Q6 and Q14 if deleted, affects most on Cronbach's alpha reducing it to 0.938.
- This shows that in surveyed organizations giving value to the stakeholder and involving stakeholder in Agile project planning is the most important factor as measured by Q2 and Q3 (i.e., At the start of the project we identify our key stakeholder groups and their goals, We have regular discussions with key stakeholder groups to understand their goals throughout the project).
- As claimed in this study that the most important factor of self organizing team as measured via Q6 (i.e Each iteration/sprint we hold a planning meeting where the team determines who will do what, in that iteration) can also affect the Cronbach's alpha as evaluation of team progress and organizing the team according to project needs is also a criteria of Agile project management practices.
- Observation also show the requirement of self organizing team measured via Q14 (i.e. I am confident about my ability to do my job) is the most critical factor as if the team members do not possess the ability to do a job well then they cannot benefit from practicing Agile project management methodologies.

Observation from the Correlation calculations:

- Bi-variate statistics and Pearson correlations for most of the entries show the strong relationship and high confidence level. As evident from Table 3, all four dimensions measured in Q11 to Q22 are strongly correlated.
- As observed from Table 2 strong correlation is seen in variables (Q1 – Q10) that measure the level of Team in following Agile project management practices with the variables (Q11 to Q22) that measure if the Team is self organizing.
- If we closely study Table 2 it is observed that Q17 and Q19 (I have significant autonomy in determining how I do my job, I have considerable opportunity for independence and freedom in how I do my job.) does not show any strong correlation with Q7 to Q9 which means that in surveyed organizations attribute of self determinations needs to be focused on, with respect to the criteria of continual process of improvement.
- Comparison of respondents in groups of three Organizations surveyed:
- As mentioned above the three different organizations have been selected, and in this study, the organizations will be represented as Company A, Company B and Company C for the sake of confidentiality.

A comparative analysis for software development teams in three selected organizations is done, to better analyze the relation of practicing agile methodologies and self-organizing teams with variable team size and experience in practicing agile methodologies.

Following Table-4 shows the comparison of means for three organizations:

Table 4: Comparison of Means for Company A, B, and C

Questions	Mean Company-A	Mean Company-B	Mean Company-C
Q1	3.75	4.78	5.14
Q2	3.95	5.67	5.76
Q3	4.2	5.11	5.71
Q4	4.3	4.89	5.33
Q5	4.5	5.11	5.81
Q6	4.2	5.89	6.29
Q7	4.3	5.33	5.67
Q8	3.7	4.78	4.52
Q9	3.75	5.22	4.71
Q10	4.05	5	4.71
Q11	5	6	5.71
Q12	5.05	5.44	5.57
Q13	5.15	5.33	5.67
Q14	5.1	6	6.1
Q15	4.9	5.78	5.95
Q16	4.95	5.22	5.43
Q17	5.05	5.44	5.52
Q18	4.75	5.11	5.62
Q19	4.95	5.22	5.57
Q20	4	4.11	5
Q21	4.1	4.33	4.19
Q22	4.15	4.22	4.29

- From the comparison of means, it can be stated that the Team A from company A claiming to be following Agile management practices is not able to fulfill the agile project management criteria.

- When we compare Means of Company B and Company C, the means for Q1 to Q10 are observed to be greater than equal to 5 representing that these organizations are meeting the criteria of Agile project management.

To further investigate the relationship of meeting Agile project management criteria and attributes of Self-organizing teams we perform a comparison of Means from Q11 to Q22 for Company A, Company B, and Company C.

- From Table 4 it can be observed that Company A has a lower set of mean values in comparison to other two companies from Q1 to Q19 which proves that there is a direct relationship, in how one team practice Agile methodologies and the extent to which a team is self organizing.

- Company B, and C seems to have all significant attributes of Meaning, Competence, and Self-determination and they can perform well in practicing Agile methodologies whereas Company A does not fulfill the criteria of practicing Agile methodologies and their team does not possess the attributes of a self-organizing team that Company B and C have.

- An additional observation from Table-4 is that in all three cases the attribute of Impact is low having neutral response overall.

V. CONCLUSIONS

According to the analysis, it is concluded that there is a direct relationship between practicing

Agile methodologies and self-organizing teams. As discussed in literature review many authors have pointed out the importance of self-organizing teams for successful implementation of agile methodologies in project management. But no one has provided a tool that can help organization in measuring the level of practicing agile methodologies and building self organized teams, who can successfully implement agile methodologies in project management.

As evident from analysis of the data collected that although companies do claim to practice Agile methodologies but are unable to fulfill the criteria of agile project management.

This study will help the organizations evaluating their teams with respect to criteria defined for practicing the agile methodologies. It will also help the organization to determine that, are their teams self-organizing and posses the minimum attributes of self-organizing teams that in our study Company B and Company C posses.

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Appendix A

1-Very Strongly Disagree

2- Strongly Disagree

3- Disagree

4- Neutral

5- Agree

6- Strongly Agree

7- Very Strongly Agree

Table 5: How Agile you are?

SNo		1	2	3	4	5	6	7
Questions For measuring How Agile Organization is? According to Team under analysis								
1	We are producing working software every iteration/sprint during product development							
2	At the start of the project we identify our key stakeholder groups and their goals							
3	We have regular discussions with key stakeholder groups to understand their goals throughout the project							
4	We perform our own regression testing on a regular basis							
5	We demo the solution to stakeholders every iteration/sprint during product development							
6	Each iteration/sprint we hold a planning meeting where the team determines who will do what, in that iteration							
7	We hold daily stand-up meetings to coordinate our activities							
8	We hold a retrospective/reflection session at the end of each iteration/sprint to identify potential improvements for our team							
9	We measure and track our progress of adopting improvements to our process							
10	We are implementing improvements to the business process							

Table 6: Measuring Self Organizing Teams

SNo		1	2	3	4	5	6	7
Meaning Items								
11	The work I do is very important to me.							
12	My job activities are personally meaningful to me.							
13	The work I do is meaningful to me.							
Competence Items								
14	I am confident about my ability to do my job							
15	I am self-assured about my capabilities to perform my work activities.							
16	I have mastered the skills necessary for my job.							
Self-determination Items								
17	I have significant autonomy in determining how I do my job.							
18	I can decide on my own how to go about doing my work.							
19	I have considerable opportunity for independence and freedom in how I do my job.							
Impact Items								
20	My impact on what happens in my department is large.							
21	I have a great deal of control over what happens in my department							
22	I have significant influence over what happens in my department.							

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APPENDIX B

Power and precision Report

Power for a test of the null hypothesis

One goal of the proposed study is to test the null hypothesis that the correlation in the population is 0.00. The criterion for significance (alpha) has been set at 0.050. The test is 2-tailed, which means that an effect in either direction will be interpreted.

With the proposed sample size of 50 the study will have power of exceeding 99.9% to yield a statistically significant result.

This computation assumes that the correlation in the population is 0.92. The observed value will be tested against a theoretical value (constant) of 0.00

This effect was selected as the smallest effect that would be important to detect, in the sense that any smaller effect would not be of clinical or substantive significance. It is also assumed that this effect size is reasonable, in the sense that an effect of this magnitude could be anticipated in this field of research.

Precision for estimating the effect size

A second goal of this study is to estimate the correlation in the population. Based on these same parameters and assumptions the study will enable us to report this value with a precision (95.0% confidence level) of approximately plus/minus 0.05 points.

For example, an observed correlation of 0.92 would be reported with a 95.0% confidence interval of 0.86 to 0.95.

The precision estimated here is the. Precision will vary as a function of the observed correlation (as well as sample size), and in any single study will be narrower or wider than this estimate.

Notes

Power computation: Fisher Z approximation (when null=0, exact formula is used)
Precision computation: Fisher Z approximation

Implementation of an Efficient Hardware Architecture for Multimedia Encryption and Authentication using the Discrete Wavelet Transform

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ABSTRACT

This paper introduces a zero-overhead encryption and authentication scheme for real-time embedded multimedia systems. The parameterized construction of the Discrete Wavelet Transform (DWT) compression block is used to introduce a free parameter in the design. It allows building a key space for lightweight multimedia encryption. The parameterization yields rational coefficients leading to an efficient fixed point hardware implementation.? Comparison with existing approaches was performed to indicate the high throughput and low hardware overhead in adding the security feature to the DWT architecture. The project will be implemented using HDL. Simulation will be done to verify the functionality and synthesis will be done to get the NETLIST. Simulation and synthesis will be done using Xilinx Tools.

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I. ABSTRACT

This paper introduces a zero-overhead encryption and authentication scheme for real-time embedded multimedia systems. The parameterized construction of the Discrete Wavelet Transform (DWT) compression block is used to introduce a free parameter in the design. It allows building a key space for lightweight multimedia encryption. The parameterization yields rational coefficients leading to an efficient fixed point hardware implementation. Comparison with existing approaches was performed to indicate the high throughput and low hardware overhead in adding the security feature to the DWT architecture. The project will be implemented using HDL. Simulation will be done to verify the functionality and synthesis will be done to get the NETLIST. Simulation and synthesis will be done using Xilinx Tools.

Keywords: compression, encryption, DWT, multimedia.

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II. INTRODUCTION

Digital image processing is an area characterized by the need for extensive experimental work to establish the viability of proposed solutions to a given problem. An important characteristic underlying the design of image processing systems is the significant level of testing & experimentation that normally is required before arriving at an acceptable solution. This characteristic implies that the ability to formulate approaches & quickly prototype candidate solutions generally plays a major role in reducing the cost and time required to arrive at a viable system implementation.

An image may be defined as a two-dimensional function $f(x, y)$, where x & y are spatial coordinates, & the amplitude of f at any pair of coordinates (x, y) is called the intensity or gray level of the image at that point. When x, y & the amplitude values of f are all finite discrete quantities, we call the image a digital image. The field of DIP refers to processing digital image by means of digital computer. Digital image is composed of a finite number of elements, each of which has a particular location & value. The elements are called pixels.

III. METHODOLOGY

A new parameterized construction of a DWT filter with rational coefficients is proposed. The parameterized construction can be used to build a key scheme while the rational coefficients of the DWT enable an efficient hardware architecture using fixed point arithmetic. The DWT, is an essential part of modern multimedia compression algorithms, thus serves as a transformation-cum-encryption block. The main contribution of this work can be summarized as 'Introduction to the concept of the parameterized DWT architecture for providing security to the images'. The new DWT architecture implements DWT as an encryption operation, Optimize and pipeline the hardware architecture to achieve a high clock

frequency of 244 MHz with minimum hardware requirements, Provide some experimental results of image encryption and watermarking using the parameterized DWT operation.

IV. LITERATURE SURVEY

Image compression algorithm, have the property that the bits in the bit stream are generated in order of importance, yielding a fully embedded code. The embedded code represents a sequence of binary decision that distinguishes an image from the "null" image. Using an embedded coding algorithm, an encoder can terminate the encoding at any point there by allowing a target rate to be met exactly. Algorithm, which generates a separate embedded bit stream for each code-block, is named as Bi. The coder is essentially a bit-plane coder.

The wavelet transformation divides image to low and high pass filtered parts. The traditional JPEG compression technique requires lower computation power with feasible losses, when only compression is needed. The methods are intended to the applications in which the image analyzing is done parallel with compression. Furthermore, high frequency bands can be used to detect changes or edges. Wavelets enable hierarchical analysis for low pass filtered sub-images. The first analysis can be done for a small image, and only if any interesting result is found, the whole image is processed or reconstructed.

Multimedia data security is important for multimedia commerce. Previous cryptography studies have focused on text data. The encryption algorithms developed to secure text data may not be suitable to multimedia applications because of large data sizes and real time constraint. For multimedia applications, lightweight encryption algorithms are attractive.

While encryption standards such as DES and RSA can be used to encrypt the entire video file, but it main drawbacks, since multimedia data is usually large and requires real-time processing, DES and RSA incur significant overhead. Recent video encryption algorithms have focused on protecting the more important parts of the video stream to reduce this overhead.

The architecture of a fully pipelined AES encryption processor is made on a single chip FPGA. By using loop unrolling and inner-round and outer-round pipelining techniques, a maximum throughput of 21.54 Gbits/s is achieved. A fast and area efficient composite field implementation of the byte substitution phase is designed using an optimum number of pipeline stages for FPGA implementation. Advanced Encryption Standard has led to intensive study of both hardware and software implementations.

A high performance encryption/decryption core of the advanced encryption standard (AES) is also presented. This architecture is implemented on a single-chip FPGA using a fully pipelined approach. The results show that this design offers up to 25.06% less area and yields up to 27.23% higher throughput than the fastest AES. FPGA implementations reported to date

These restrictions can be alleviated by developing a scheme that integrates both encryption and compression operations into in a Figure 1.

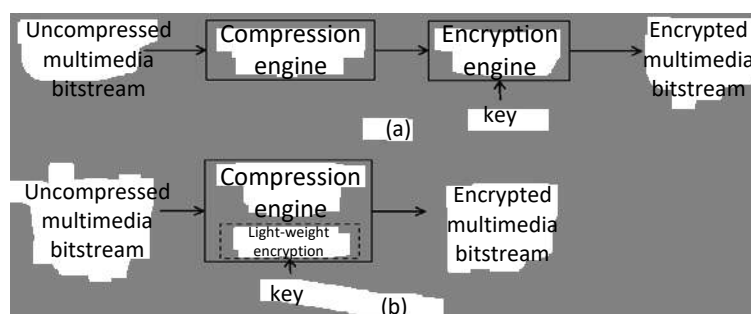*Figure 1:* Lightweight multimedia encryption scheme

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Consider an example to explain the significance of lightweight multimedia encryption schemes for embedded systems. In Figure 2 a surveillance aircraft (A) is sending aerial surveys and other important information to the ground troops (B), crucial for their attack on the enemy base (C). In this scenario, typical encoding schemes would require large computational resources and hence high power consumption making them unsuitable for real-world embedded systems. Moreover such conventional ciphers would incur a large latency in image transmission which can be critical for ground troops' (B) operation.
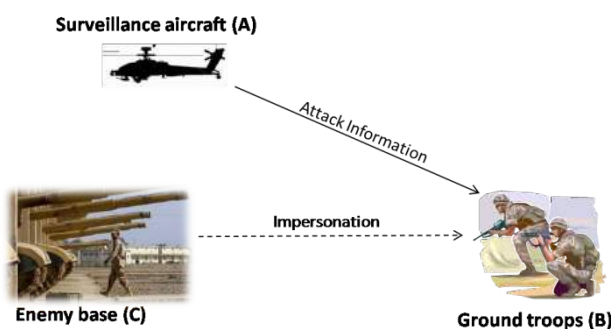

Figure 2: Example scenario for proposed lightweight multimedia encryption

Efficient hardware architecture using parameterized DWT

For image compression purposes, JPEG 2000 recommends an alternate row/column-based structure as presented in Figure 3
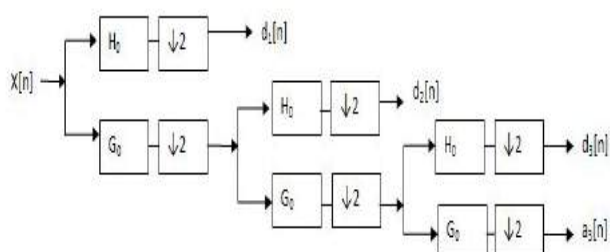

Figure 3: 3-Level DWT decomposition tree

To obtain the first transformation level of DWT the BWFB derivation was done. Through this derivation two filter characteristic equations namely synthesis low pass filter and analysis high pass filter characteristic equations were obtained, which are as follows:

H_1 (z) = [(-9/64) a+ (1/32) a^2 + (15/64) - (1/8) (1/a)] (z^4+1/z^4) + [(-1/16) a^2 + (11/32) a - (11/16) + (1/2) (1/a)] (z^3+1/z^3) + [(1/8) - (1/2) (1/a)] (z^2+1/z^2) + [(-11/32) a + (1/16) a^2 + (15/16)-(1/2) (1/a)] (z+1/z)+[(9/32) a-(1/16) a^2 - (7/32) + (5/4) (1/a)] ....(1)

H_2 (z) = [(1/32)-(1/32) a](z^3+1/z^3) + [(1/8)-(1/16) a] (z^2+1/z^2) + [(7/32) + (1/32) a] (z+1/z) + [1/4+ (1/8) a] ....(2)

These two equations mainly consists of more number of adders, multipliers, and irrational coefficients which results in much requirement of hardware, thus more power consumption, more delay and reduced amount of efficiency. Thus to overcome the above problem the above equations are simplified to their binary equivalent form, which can be expressed as follows:

H_1 (z) = [-$(1/2^3+1/2^6)$ a + $(1/2^5)$ a^2 + $(1/2^2-1/2^6)$ − $(1/2^3)$ (1/a)] (z^4+1/z^4) + [$(-1/2^4)$ a^2 + $(1/2^2+1/2^4+1/2^5)$ a + $(1/2+1/2^3+1/2^4)$ + [(1/2) (1/a)] (z^3+1/z^3) + [$(1/2^3-1/2$ (1/a))] (z^2+1/z^2) +[-$(1/2^2+1/2^4+1/2^5)$ a + ($1/2^4)$ a^2 + (1-($1/2^4)$ − (1/2)(1/a)](z+1/z)+[$(1/2^2+1/2^5)$ a -($1/2^4)$ a^2 - $(1/2^2-1/2^5)$ + (1+ $1/2^2)$ (1/a)] ....(3)

H_2 (z) = [$(1/2^5-1/2^5)$ a] (z^3+1/z^3) + [$(1/2^3- (1/2^4)$ a] $((z^2+1/z^2)$ + [$(1/2^2-(1/2^5)$ + $(1/2^5)$ a])] (z+1/z) + [$(1/2^2 + 1/2^3)$ a] ....(4)

Thus it can be concluded that the above equations mainly consists of less number of adders, multipliers and shifting operations only, which can be implemented using less amount of hardware.

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V. DATA ENCRYPTION

Mounting concern over the new threats to privacy and security has lead to widespread adoption of cryptography. Cryptography is the science of trans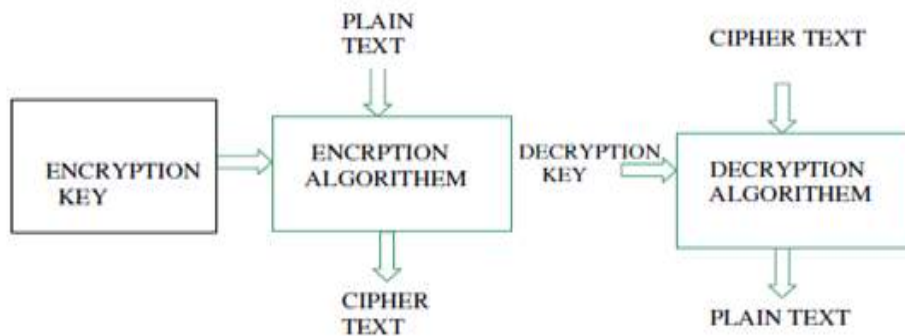forming documents. It has main functions are encryption and decryption. Figure 4 shows process of Encryption and Decryption only after decoding the cipher text using the key the content of the document is revealed to the common people Figure 4: Encryption and Decryption.

Figure 4: Encryption and Decryption

5.1 Implementation of Encryption through DWT Architecture

Using free parameter 'a' which is introduced in previous Parameterized DWT, we can provide encryption for image with a zero-overhead of hardware. Number of bits of keyspace 'a' depends of image which is going to transmit and DWT decomposition. For Example the number of DWT operations 'N' in an image of size M×M pixels is bounded by the limit N≤ $log_e(M)$. we can obtain go up to maximum of nine levels of wavelet decomposition for an image of size 512×512 pixels. One level of wavelet decomposition involves two filtering operations: one each along the row and column directions.   9x2 (rows + column) =18. Thus, we can choose up to 18 different 'a' values, one each for the 18 different instances of DWT kernels being used in the operation. Each 'a' represents 8-bits so totally 144-bits of keyspace for 512x512 image. 18x8=144-bits keyspace. These 144-bits keyspace can be used to encrypt the input frame. This level of security is sufficient for any mobile multimedia application.

VI. CONCLUSION

This paper introduces a multimedia encryption and watermark authentication framework based on parameterized construction of DWT. The parameterization enables an efficient, pipelined, high throughput implementation in hardware. The qualitative and quantitative results in terms of both hardware performance and image security promise a secure framework for real-time multimedia delivery over embedded systems

Future scope

The idea of parameterization can also be extended to other multimedia encoding blocks to obtain a more powerful integrated-encryption-scheme for embedded multimedia systems.

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Listening to Data: Interpreting Twitter Sentiment Analysis using Tone Analyzer and Personality Insights of PAG-ASA and Phivolcs

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ABSTRACT

Twitter, a microblogging site plays a vital role in spreading information during natural disasters. The volume of tweets posted during crisis and disaster tend to be extremely high, making it hard for disaster-affected communities and disaster management team of a local government unit to process the information in a timely manner. In this research, we describe different data mining techniques that can be used for extracting information from microblog posts that will be a basis of creating a machine learning called Disastweet: An Open-Source Tweet Mining Tool for Disaster Management. Specifically, we focus on extracting valuable information from tweets that is brief, self-contained relevant to disaster response.

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Stephan Kupsch[α], Randy Joy M. Ventayen[σ], Christianne Lynnette G. Cabanban[ρ] & Thelma D. Palaoag[¥]

I.   Abstract

Twitter, a microblogging site plays a vital role in spreading information during natural disasters. The volume of tweets posted during crisis and disaster tend to be extremely high, making it hard for disaster-affected communities and disaster management team of a local government unit to process the information in a timely manner. In this research, we describe different data mining techniques that can be used for extracting information from microblog posts that will be a basis of creating a machine learning called Disastweet: An Open-Source Tweet Mining Tool for Disaster Management. Specifically, we focus on extracting valuable information from tweets that is brief, self-contained relevant to disaster response.

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II.   INTRODUCTION

Social media networks and microblogging services such as Twitter has redefined the floodgates of information dissemination through pervasiveness of Information and Communication Technology (ICT).

Members of the society turn to social networking sites, microblogging services and similar technologies to better understand and communicate during emergency situations by focusing on Twitter communications also called as tweets generated during mass emergency, and eventually showcasing.

Natural Language Processing (NLP) techniques to contribute to the task of analyzing through massive datasets infeasible for the emergency-management community, including the medical and public health professionals, to effectively find it, make sense of, and act on it. By merely sharing images, status updates and tweeting, the members of the public is already becoming part of a larger response network rather than a mere bystanders or casualties.

Typhoon Haiyan hit the central Philippines on November 8, 2013, killing 6,190 people and leaving 14.1 million people in need of immediate assistance. Over four million people were forced from their homes with more than a million houses destroyed or damaged. Many of the people who were displaced were already amongst the poorest in the Philippines and following the typhoon found themselves living in tents or evacuation centres.[1]

When disaster events capture global attention users of Twitter form transient interest communities that disseminate information and other messages online. Twitter data were collected the day before super typhoon Haiyan (locally known as Yolanda) and for 18 days afterwards. Haiyan was a trending topic on Twitter for over two weeks, with activity coming from many countries.
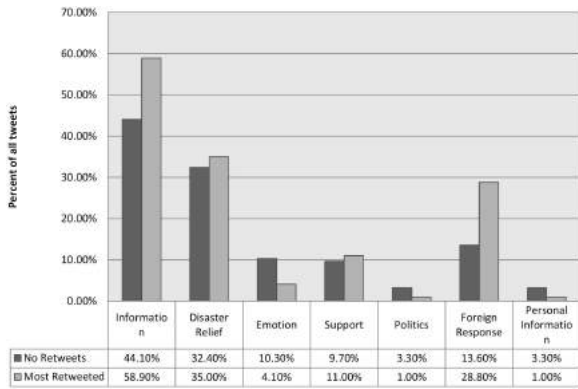
Figure 1: Content distribution of tweets during the Typhoon Haiyan

Figure 1 shows general content category distributions for both the most retweeted messages and messages without retweets. While 59% of the most retweeted messages contain information about the typhoon, a smaller portion (43%) of the general Twitter messages contains information. Results show that these tend to contain more messages with emotion, personal information, and commentary about politics, although these do not occur frequently. Among the original tweets, 10% of messages have content about emotions, compared to a smaller 4% among the most retweeted messages. Personal information in general does not get tweeted often, however given the scale of Twitter, even small proportions could be consequential. There are more instances of personal information tweets from original posts compared to the retweeted messages. Of note is a dearth of messages related to politics. [2]

In this research, we describe different algorithms that can be used for extracting information from microblog posts using Apache Spark on IBM Bluemix. We use the twitter handle of Department of Science and Technology - PAG-ASA and Phivolcs as a tool in assessing sentiment analysis of its' followers.

III.   METHODOLOGY

The focus on creating a machine learning app that uses Spark Streaming is to create a feed that captures live tweets from Twitter. The user can optionally filter the tweets that contain the hashtag(s) of their choice. The tweet data is enriched in real time with various sentiment scores provided by the Watson Tone Analyzer service.
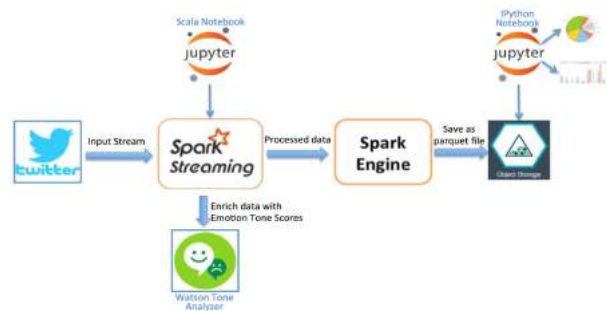

Figure 2: Basic Architecture of Spark Streaming

This service provides insight into sentiment and then use Spark SQL to load the data into a DataFrame for further analysis as seen in Figure 2.

The three algorithms utilized are Naïve Bayes, Logistic Regression and Decision Trees in this research.

3.1 Naïve Bayes

Naive Bayes is a simple multi-class classification algorithm based on the application of Bayes' theorem. Each instance of the problem is represented as a feature vector, and it is assumed that the value of each feature is independent of the value of any other feature. One of the advantages of this algorithm is that it can be trained very efficiently as it needs only a single pass to the training data.

3.2 Logistic Regression

Logistic regression is a regression model where the dependent variable can take one out of a fixed number of values. It utilizes a logistic function to measure the relationship between the instance class, and the features extracted from the input.

3.3 Decision Trees

The decision tree is a classification algorithm that is based on a tree structure whose leaves

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represent class labels while branches represent combinations of features that result in the aforementioned classes. Essentially, it executes a recursive binary partitioning of the feature space.

IV. RESULTS AND DISCUSSION

The tweets are analyzed using Watson Personality Insights as deemed in Figure 3 that requires at least 100 words from its lexicon to be available, which may not exist for each user. This is why the getPersonlityInsight helper function guards against exceptions from calling Watson PI. If an exception occurs, then an empty array is returned. Each record with empty array is filtered out of the resulting RDD.

```
+-----------+-------------+-------------+-----------+---------------+---------+
|     userid|Emotional range|Agreeableness|Extraversion|Conscientiousness| Openness|
+-----------+-------------+-------------+-----------+---------------+---------+
|phivolcs_dost|    0.4298609|    0.7124939|   0.53390217|      0.59583825|0.7434547|
|  dost_pagasa|   0.37862363|   0.71802986|    0.5235555|      0.59549797|0.7920747|
+-----------+-------------+-------------+-----------+---------------+---------+
```

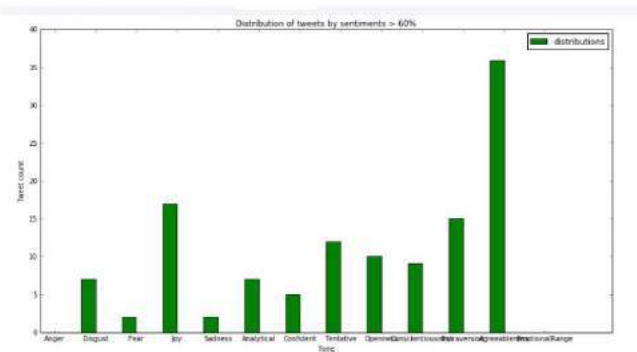*Figure 3:* Watson Personality Insight Results

Figure 4: Real time visualization

V. CONCLUSION

Social Media Networks specifically Twitter have emerged as an important source of information. These sources may not be primarily used in prediction of the disasters, hence it contributed significantly to early detection and adaption for appropriate disaster management response. The researcher propose to build a machine learning based on these concepts for Phase 1. Our aim for the phase II is to extract meaningful information from tweets during natural disasters. We can use machine learning tool that the researcher will be

developing to extract valuable information from noisy social media data.

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Effect of Flipped Learning on Students Achievement in Computer Science in Tertiary Institution in Enugu State

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ABSTRACT

The researcher investigated the effect of flipped method on students' achievement in computer science tertiary institutions in Enugu state of Nigeria using quasi-experimental design. The instrument for data collection was pretest - posttest non equivalent control group. The population for the study comprised all higher institutions in Enugu state. Data were collected from a sample of 152 students selected from two secondary higher institutions. A reliability coefficient of 0.89 was obtained from the instrument through test retest. Mean and standard deviation scores were used to answer the research questions, while two-way analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significant. The findings show that students exposed to learning using flipped method achieved higher than those taught with traditional method. It was recommended that ministry of education should revisit the instructional materials used in teaching.

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I. Abstract

The researcher investigated the effect of flipped method on students' achievement in computer science tertiary institutions in institution in Enugu state of Nigeria using quasi-experimental design. The instrument for data collection was pretest - posttest non equivalent nonequivalent control group. The population for the study comprised all higher institutions in Enugu state. Data were was collected from a sample of 152 students selected from two secondary higher institutions. A reliability coefficient of 0.89 was obtained from the instrument through test retest test-retest. Mean and standard deviation scores were used to answer the research questions, while two-way analysis Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significant. The findings show that students exposed to learning using flipped method achieved higher than those taught with the traditional method. It was recommended that ministry of education should revisit the instructional materials used in teaching.

II. INTRODUCTION

Traditional teaching methods have dominated classrooms for decades. It is a learning scenario that is teacher-centred and imposes an inflexible lecture style. Lessons are taught by the teacher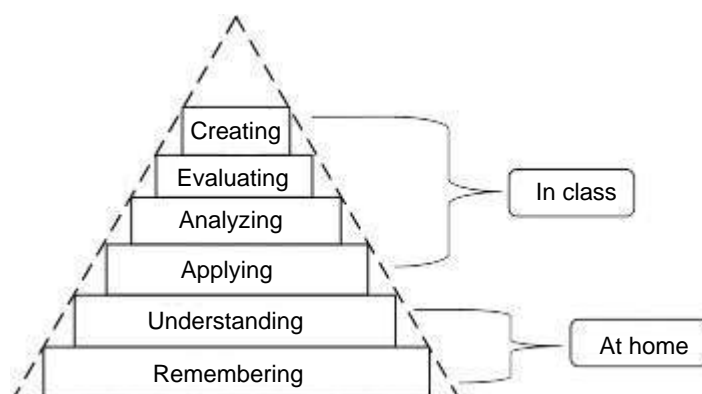 introducing skills using a blackboard/ whiteboard accompanied by a verbal explanation. In this situation, learning is associated within the classroom and is often competitive. The lesson content and delivery are considered to be most important, and students master knowledge through drill and practice (such as rote learning). The problem with traditional method is often a matter of pace. Some students, the information may come too slowly or cover what they already know; other students may have trouble taking in information so rapidly, or they may lack the prior knowledge they need in order to understand the concepts. After a hit-or-miss lecture, teachers often assign homework, which many students perform in private mainly with frustration and confusion. Traditional teaching is concerned with the teacher being the controller of the learning environment. Power and responsibility are held by the teacher, and they play the role of instructor (in the form of lecturers) and decision makers with regards to curriculum content and specific outcomes. They see students as people who are hungry for knowledge. In the traditional method, it is the teacher's view that it is the teacher that causes learning to occur (Novak, 1998). It perhaps, explains why it is always difficult for students to understand some topics in computer science.

In teaching computer science courses, some topics are so abstract that it requires absolute student engagements in practical. In other parts of the world, students are engaged using several teaching methods in the form of flipped classroom. This is because it allows active learning, student engagement, hybrid course design, and course podcasting. It repositions the

class and students have the ability to interact with one another in practical activities. The instructor coaches or advises and encourages students in individual inquiry and collaborative effort.

Flipped classroom is a type of learning scenario that reverses traditional teaching method and allows students gain first exposure to new material outside the classroom, usually via reading or lecture videos, and then class time is used to do the harder work of assimilating that knowledge through strategies, such as problem-solving, discussion or debates. Bergman and Sams (2012) stated that direct instruction is could be delivered by recording video content for students to engage with before class (and any time) freeing up class time for activities that allow deeper exploration of content. Wikipedia (2016) noted that in a flipped classroom, students watch online lectures, collaborate in online discussions, or carry out research at home and engage in concepts in the classroom with the guidance of a mentor.

According to Knewton infographics (2016), about 69% of students who start high school finishes

four years later while 31% do not finish due to traditional classroom method of teaching. What this suggests is that 7,200 students drop out of high school each day totaling totalling 1.3 million per year. In the flipped classroom, students can get the most out of class time by spending it on practical application, not on inactive lecture (Cole, 2009). Students in this model generally have a more active role and ultimate responsibility for their learning (Gallagher, 2009). They must follow through on viewing the lecture; they must engage during class through a variety of methods. Overmyer (2012) observes that the model is useful where content is usually more technical and linear. Flipped learning is base based on Bloom's revised taxonomy (2001). It this means that students are doing the lower levels of cognitive work (gaining knowledge and comprehension) outside of class, and focusing on the higher forms of cognitive work (application, analysis, synthesis, and/or evaluation) in class, where they have the support of their peers and instructor.

This model contrasts with from the traditional model in which first exposure occurs via lecture in class, with students assimilating knowledge through homework. Through the use of computer technology, flipped learning method captures content for students to access at their own convenience and to suit their pace of learning (e.g. lecture material, readings, interactive multimedia), organises content for students to gather their own resources, presents learning materials in a variety of formats to suit different learner styles and multimodal learning (e.g. text, videos, audio, multimedia), provides opportunities for discourse and interaction in and out of class (e.g. polling tools, discussion tools, content creation tools), conveys timely information, updates and provides reminders for students (e.g micro-blogging, announcement tools), provides immediate and anonymous feedback for teachers and students (e.g. quizzes, polls) to signal revision points, captures data about students to analyse their progress and

identify 'at risk' students (e.g. analytics). If When this method is employed, it will enhance the way instruction is delivered in tertiary institutions.

As noted by Odo and Odo (2015), tertiary education in Nigeria comprises undergraduate, postgraduate, and vocational training. Usually, an individual needs to be admitted into a college, polytechnic or university to receive tertiary education. It is the most specialized form of education where a particular course of study is taken. Upon completion of the course, an academic degree, diploma or certificate is issued to help make an individual a better human.

On completion of the course, the individual receives an academic degree, diploma or certificate that will help such an individual to be a better human being. The apparent gap between what is acquired in school and the reality of the workspace has to be attributed to poor learning condition caused by the traditional method of instruction. Computer science education is a great enterprise which nations depend on in order to advance technologically. Therefore, this course should receive much emphasis in education because of its significance and relevance to life and society.

However, gender is considered as a factor in this study because it may be that male and female may have differences in achievement when flipped learning is used in teaching. It may be because gender is a biological difference between male and female in their reproduction. Nworgu (2005) noted that there exists gender difference in science achievement. It is from against the above, that the researcher intends to find out the effect of flipped learning method on students' achievement in Computer science.

2.1 Statement of the problem

The persistent use of the traditional method of instruction in this part of the world has adversely affected students' achievement in computer science over the years. It has left students to be passive learners rather than active listeners. This method usually leaves students with nothing but to note down every word without adequate understanding of the content. This ugly situation will eventually make Nigerian graduates not to be comfortable in the competitive world.

2.2 Purpose of study

The purpose of this study is to determine the effect of flipped learning on students' achievement in computer science in tertiary institutions in Enugu state. Specifically, the study tends to determine;

1. The effect of flipped Method of Instruction (FMI) on students' achievement in computer science.
2. The effect of FMI and Traditional Method of Instruction (TMI) on male and female achievement in computer science.

2.3 Research questions

The following research questions guided the study

1. What is the mean achievement score of student taught with FMI and those taught using traditional method?
2. What is the mean achievement score of male and female student taught with FMI and those taught using the traditional method as measured by Flipped Computer Science Achievement Test (CSAT)?

2.4 Research hypotheses

The three hypotheses tested at 0.05 level of significance:

HO1: There is no significant difference in the mean achievement scores of students taught with FMI and those taught with the traditional method.

HO2: There is no significant difference in the mean achievement score of male and female students taught with FMI and those taught with the traditional method as measured by (FLAT).

HO3: There is no significant difference in the interaction effect of gender and teaching method on the students' means achievement scores.

III. METHODS

Quasi experimental design was used for the study. It utilized pre-test, post-test non-equivalent control group design. This design was used because of non-randomization of subjects. The research subjects were not randomized because of the problems of re-arrangement or re-grouping of intact classes. The population of the study consists of 827 computer science students from all government owned higher institutions in Enugu state. The study has sample size 152 science students consisting of 82 female and 70 male. The study utilized stratified and simple random sampling technique. The sample was stratified into universities, Polytechnics and Colleges of Educations. Then simple random technique was used to select two universities, one polytechnic and one college of education. All the year one computer science class students were used as research subjects in each of the sampled schools. Therefore, in each school, one intact class was assigned to Flipped Method of Instruction (FMI), while the other intact class was assigned a Traditional Method of Instruction (TMI). Database Management Achievement Test (DMAT) was used as instrument for the study. The instrument consisted of 50 multiple choice objective test developed by the researcher. The measuring instrument was based on database management content of qualitative analysis subdivided into data gathering and data grouping tests, tests for actual database development (creation of tables) and tests for query and interface creation and reports. The instrument was validated by three experts, one from computer science and the other two from measurement and evaluation. The reliability of DMAT was determined by administering the test to Ebonyi state university of Nigeria using test retest method. The correlation coefficient of the two sets of scores yielded 0.89 using the Cronbach Alpha statistic for test of internal consistency. All the research questions were answered using mean and 2–way analysis of covariance (ANCOVA) used to test the null hypotheses at 0.05 level of significance.

IV. EXPERIMENTAL PROCEDURE

Regular computer lecturers were used for the study. These lecturers received one week training from the researcher on the use of flipped method of instruction. At the end, they were given a lecture notes as a guide. The instructional methods used for this study are the Flipped Method of Instruction (FMI) and Traditional Method of Instruction (TMI). The FMI was for the experimental group while the TMI was for the control group. In the presentation of the FMI the teacher presented the database management system development procedures which involve the following sub-headings: data gathering and grouping according to relationship, creation of tables i.e. the actual database development, creation of queries, creation of interface (forms) and finally reports. The literature of database management was given to students to go home and assimilate the contents. In the classroom, the teacher used explanation and demonstration to teach students every single step involved in development of database management system from simple to complex. On the other hand, the instructional method used for TMI includes content development, teachers' activities, and students' activities. The research subjects were given pretest to both FMI group and TMI group. The teaching commenced on the two groups and after administering the pretest, the treatment lasted for a period of four weeks after which a posttest was administered to the research subjects. The pretest was reshuffled and printed with a different colour of question paper to give the questions a different look, before it was used for the posttest. The course lecturer did the supervision. The Data collected for pretest and posttest for the two groups were used to answer the research questions and test the hypotheses.

V. RESULTS

Data from Table I indicates that the group taught with Flipped method of instruction (FMI) obtained the mean score of 45.39 for the pretest and the mean score of 83.55 for the post-test.

Table I: Mean Ratings of the Responses on the Effect of Flipped Method on Students Achievment in Computer Science**.** N = 152

| Group | Pre-test | | Post-test | | N = 152 |
	Mean	SD	Mean	SD	
SMI	45.39	8.62	83.55	9.28	77
TMI	40.05	9.29	56.00	6.50	75

However, TMI obtained the mean score of 40.05 and 56.00 for the pretest and posttest respectively. Therefore, the mean score for students exposed to FMI is higher than that of TMI. This shows that students taught with FMI method perform better in the subject than students taught using the traditional method.

Table II: Mean Ratings of the Responses on the Achievement Score of Male and Female Students Taught using Fmi and those Taught using Tmi as Measured by Database Management Achievement Test (dmat).

| Group | Pre-test | | Post-test | | N = 152 |
	Mean	SD	Mean	SD	
SMI	45.39	8.62	83.55	9.28	77
TMI	40.05	9.29	56.00	6.50	75

Table 2 indicates that male students achieved higher result (70.80 pre-test) and (82.70 post-test) than their female counterpart with 65.10 and 70.95 in pre-test and post-test respectively when exposed to FMI. Male students achieved higher result 45.40 in pre-test and 48.41 post-test while female had 41.09 and 45.80 in pre-test and post-test respectively when TMI was used. The table showed that both male and female student's achievement increased in the subject when FMI was used in teaching than traditional method.

Table III: ANCOVA on interaction effect of students' mean achievement scores by instructional method and gender.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	445.568[a]	5	89.114	2.720	.000
Intercept	130.606	1	130.606	717.605	.000
GROUP	6.893	1	6.893	9.646	.002
POSTTEST	322.709	1	322.709	3.434	.000
METHODS	0.411	1	0.411	1.013	.001
GENDER	15.205	1	15.205	1.480	.001
METHODS * GENDER	116.765	1	116.765	4.688	.001
Error	411.590	149	31.661		
Total	101525.000	152			
Corrected Total	857.158	151			

For Ho$_1$, the data in table 3 indicates that the method is significant at 0.001, which is less than 0.05 set for the study. Since the computed level of significance is less, the Ho$_1$ is rejected. It is concluded that there is a significant difference between the mean achievement scores of students exposed to FMI than those taught with TMI.

For Ho$_2$, table 3 showed that gender is significant at 0.001, which is less than 0.05 set for the study. This implies a rejection of the null hypothesis. Hence, there is a significant difference in the achievement of male and female students exposed to FMI as measured by Database Management Achievement Test (DMAT)

VI.   SUMMARY OF THE FINDINGS

1. Students that are exposed with FMI achieve higher in the computer science course (Database management) than those taught with TMI.
2. Both male and female students put learn better when exposed to FMI.
3. There is a significant difference in the mean achievement of students based on the method of instruction and gender.

VII.   DISCUSSION

The study generated information on the effect of flipped method on student's achievement in computer science in tertiary institutions in Enugu, Nigeria. The finding pertaining to research question 1 revealed that students taught with FMI show greater achievement in computer science than those taught with TMI. The findings are in line with Cole (2009) who noted that the students can get the most out of class time by spending it on practical application, not on inactive lecture. The findings is also in line with Gallagher, (2009) who noted that in flipped learning, students have a more active role and ultimate responsibility for their learning.

For research question two which sought to find the influence of FMI on male and female students in programming language. The findings revealed

that there is a difference in favour of SMI. This means that both male and female students achieve higher when exposed to FMI and this is in line with Fabunmi (2004), who discovered that gender composition has a significant relationship with students' academic performance.

For hypothesis one and two, the findings revealed that method and gender is significant. There is a significant difference in the mean score of students taught with FMI and those taught with TMI. The researcher is of the view that FMI helps to create meaningful learning, encourage students to take responsibility for their learning, learn at their own pace, deepen their knowledge and understanding and also make faster progress.

VIII.   EDUCATIONAL IMPLICATIONS

In Africa especially in Nigeria, teaching and learning are still carried out using traditional methods of chalk and blackboard. There is no access to modern technology. This is as a result of misdirected attention of stakeholders to issues of quality education for the citizens. As a result, school system is plagued with numerous social vices like examination malpractices; cultism; and infant hooliganism.

IX.   RECOMMENDATIONS

1. The Ministry of Education in Nigeria should revisit the instructional methods.
2. Teachers should strive to change from the traditional method of instruction and avail themselves of the opportunity to learn new technology of teaching.

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