Fast Mobile Wireless Network Routing based on the Clustering and Chaos-CNN

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Abstract

In this research we using intelligent algorithm such as neural network to solve the problem of routing by finding the optimal path between source and destination and clustering algorithm to find path in clusters. A new routing algorithm based on the clustering and neural network was proposed. The modification to chaotic Cellular neural network (MCCNN) was suggest, combine with proposed Modified K-Mean clustering method to make the routing more intelligent and adaptive in finding the optimal routes for ad hoc wireless network (like MANET). Routing Results show how the proposed routing algorithm were high speed comparing with Dijkstra algorithm. The different of speed gaining time with percentage 250 t0 380%. This make proposed algorithm useful in the fasting routing. Also, the results of the proposed system are optimal path not only shortest path. It depending on the group of factors and parameters to select the path between two points in the wireless network.

Keyword: Wireless routing, mobile wireless, MANET, MANET routing, Clustering, wireless network clustering, Intelligent routing.

التوجيه السريع للشبكة اللاسلكية المتنقلة بالاعتماد على العنقدة وشبكة العصبية الخلوية الفوضوية

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الخلاصة

في هذا البحث نستخدم خوارزمية ذكية مثل الشبكة العصبية في حل مشكلة التوجيه من خلال إيجاد المسار الأمثل بين المصدر والمقصد وخوارزمية التجميع لايجاد المسار في العنقدة (clusters). واقترح إنشاء خوارزمية توجيه جديد تستند إلى شبكة تجميع والعصبية. وكان التعديل هو ال(chaos)

و الشبكة العصبية الخلوية التي) تشير الى (MCCNN) ، مع الجمع بين ما اقترح من طريقة محد (K−Mean clustering) لجعل التوجيه أكثر ذكاء و تكيف لايجاد الطرق المثلى لشبكة لاسلكية (مثل MANET). وتشير نتائج التوجيه كيف كانت خوارزمية التوجيه المقترح لها سرعة عالية مقارنة مع خوارزمية ديكسترا. وتختلف سرعة كسب الوقت بنسبة ٢٥٠ الى 380٪. هذا جعل الخوارزمية المقترحة مفيدة في التوجيه السريع. أيضا، فإن نتائج النظام المقترح هي الطريق الأمثل ليس فقط أقصر الطرق. ذلك اعتمادا على مجموعة من العوامل والمعايير لتحديد مسار بين نقطتين في شبكة لاسلكية.

1. Introduction

An ad hoc network is a collection of wireless mobile nodes (or routers) dynamically forming a temporary network without the use of any existing network infra-structure or centralized administration.

The routers are free to move randomly and organize themselves arbitrarily; thus, the network's wireless topology may change rapidly and unpredictably Multihop, mobility, large network size combined with device heterogeneity, bandwidth, and battery power constraints make the design of adequate routing protocols a major challenge. [1]

Mobile Ad Hoc Network (MANET) is a self-configuring infrastructure less network of mobile devices connected by wireless links. Ad-hoc is Latin and means "for this purpose". Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Each must forward traffic unrelated to its own use, and therefore be a router. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic. The mobile ad hoc network has the following typical features: Unreliability of wireless links between nodes and Constantly changing topology.[2]

So The characteristics of MANETs like no fixed network infrastructure, dynamic network configuration, mobility of nodes and frequent node failure, low battery power, etc differentiate them from other wireless networks. Hence routing in MANETs became one of the most challenging tasks. Routing in networking is the process of selecting paths in a network to send network traffic. Therefore, the need to design a novel routing protocol which seamlessly adapt to changing network topology was inevitable. [3]

Many research in wireless network routing were explore and suggests algorithm to find the optimal shortest path for nodes. In order to supply an

overview of former work and to supply a basic theoretical understanding of the considered topic, some recent researches presented
different authors are reviewed and quote in this section some of these researches about the applying neural network to find optimal path in wireless network.

Heni Kaaniche and Farouk Kamoun , 2010 [4] a recurrent neural network has been suggest here to estimate the stability of paths in a MANETs, this neural predictor is a three-layer network with feedback connections. Back propagation has been used to train the recurrent neural network. To exam the satisfactoriness of the predictor in mobility prediction, they have tested the neural predictor on time series describe sites of an Ad hoc mobile node, improving routing by reducing the overhead it found the stable path and the number of connection interruptions.

Siddesh.G.K, et al. in 2011,[5] proposed a routing protocol in ad-hoc wireless network using software computing's technique like neutral's network, fuzzy logics and genetic algorithm. Performed simulation using various existing protocols like power aware routing protocol, proactive, reactive and hybrid routing protocols. Authors in this paper use software computing's such as artificial neural network with Fuzzy Logics and Genetics Algorithm share to improving the protocol performance in very dramatic terms, establishing the link between the nodes in minimum time and find the optimal route to a large network.

Seyed Saeed Sadat Noori , et al.in 2012[6] they propose an efficacious protocol for disjoint path set and select backup in ad-hoc wireless's networks. In this algorithm, the all trustworthy paths (among selected network nodes) can finding without needs in on demand routing algorithm to discovering new paths. The new approach it using Multi-Layer Perceptron (MLPs) neural networks to predict the probability of proper link. This MLP net updates its weights by using the back propagation error algorithm. For this reason, this type of neural network can be a perfect elect to predicting of the mobile nodes reliable links with best accuracy's.

Parimal Kumar Giri in 2012 [7] suggest the neural network based approach for MANET. By using Hopfield Neural Networks (HNNs) that made to solve or provide an convergent solution to the Shortest Path problem faster than would be possible with any algorithmic solution, relying on the Neural Networks (NNs) parallel architecture.

S. Gangwar, K. Kumar & M. Mittal in 2015 [8] because MANET have the main challenge such as Limited battery power so they suggest to routing techniques which lower the power consumption by implemented Adaptive resonance theory **(**ART1**)** neural network like a parts of the routing techniques that chooses head of the cluster rely on residual mobile node energy after the accomplishment of all data conveyance. The final result explain that ART1 algorithm has optimized residual energy and optimized the problem of cluster head selection.so the network lifetime is increased according to this method up to 58% as compared to traditional routing techniques. In this research we suggest a new intelligent routing algorithm based on the neural network and clustering technique.

2. **Mobile ad hoc Networks (MANETs)**

Mobiles ad-hoc Networks (MANETs) are typically part of wireless ad hoc networks. MANET is the wireless ad hoc network in which all device is free to move in any way independently (as shown in figure 1). Mobile ad hoc networks are the self-configuring and infrastructure-less networks aiming to support mobility of devices. Each device it will be changes links to other devices frequently resulting in distinct topology and a highly dynamic change. Each device plays the role of participant as well as router and/ or sender, receiver of the network [9].

Traditionally, mobile ad hoc network (MANETs) was proposed for military's application to ameliorate combat-zones communication and not relying on stables communications infrastructures operation.

In this network, the nodes move haphazardly, that can have caused networks topologies can be changing in dynamical ways and height excessively; these results' in routing can changing it consider a good opportunity of packets rebating. Every nodes' can be behaving like routers and produce packets independent; because network management was spread across different nodes; therefor occasionally difficult to detection the faults in this networks.

In MANETs, software/hardware configuration different make a processing capabilities may have in each node. In this type of network routing protocols more complex to design in case of unpredictable alteration.

Scalabilities networks are ticklish to the large deployments in them. To make large network consider big defies like route paths, locations managements, addressing, configurations managements, securities, and highest capacity's wireless's technology. [10]

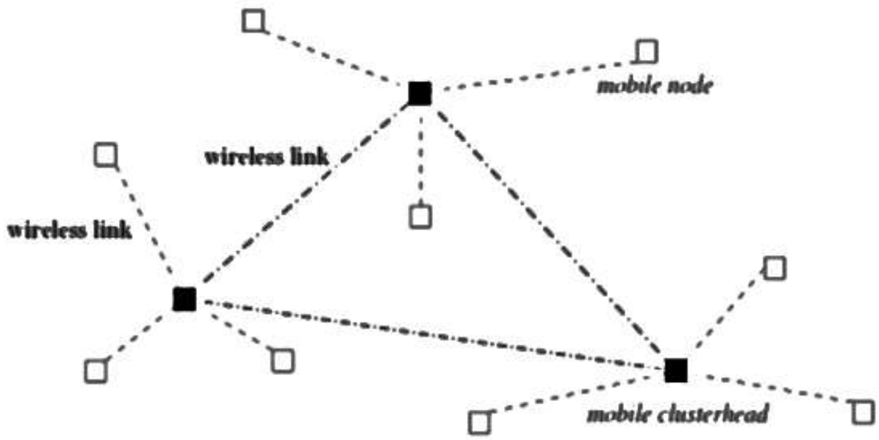


Figure 1. A Mobile Ad hoc Network (MANET) [11]

3. Routing and Clustering

In network **Routing** is choosing the tracks to transmit networks traffics'. Routings were classified in a hierarchical structures or flat structure. Nodes in the network with the flat structure have similar hierarchies' levels and be the similar roles. In spite of this method is useful in smallest network, if the nodes number in the network [increases this method it is not suitable. Because in big network, the routing structures produced exaggerated packets stream that cannot saturated the networks. Hierarchical structure it reflexes of flat structure it is suitable to use in large networks. [12]

A routing algorithm can be considering as a part of the programs accomplished by the network layer and it will be accountable for convey traffic packets from their sources to their destinations or can be defined as the set of software. In Ad-hoc networks Routing algorithms have become a never-ending evolving matter.

The losing of communication is one of the important challenging of routing on ad-hoc networks. Manifestation this phenomenon happens when they move out of covered regions or when terminals are turned off. So one of earnest problems on networks it Losses of communication [13]. So, to convey data from one node to another node, there are some type of routing protocols will have used to do this transmits of data without any loss. Protocols are combination of regulations and rules that can be used in network communication. [14]

Clustering is a method which aggregates nodes into group's .These groups are contained by the network and they are known as clusters. A cluster is basically a subset of nodes of the network that satisfies a certain properties. [15]

So the Clustering means a way to reconfigure all nodes into small virtual groups according to their regional vicinity and is defined as Cluster Head (CH) and cluster members that are determined with the same rule. Every clustering algorithm consists of two mechanisms: cluster formation and cluster maintenance. [16]

4. **Cellular Neural Network (CNN)**

Images processing functions are very exacting processing and operations. So that, real-time processing applications not depend on the serial processing [10]. CNN generally non-linear dynamics operation systems type of recurrent Neural Network with analogs and continuous operation time. [12]. parallel computing is one of CNN attributes like to neural network, but differ in with communication between units neighbor [10]. The CNN depend on interaction types of the nearest neighbors. Due to its flexibility, it applied in several approaches like signals processing, image operations, patterns recognition, motion objects detection, targets classification, augmented reality, and solving partial differential equations. It is powerful for image processing in real time. Also, the parallel processing in CNN reduce time of the computational.

The CNN basic unit named as cell. It includes elements (linear and non-linear). each cell has main attribute is: inputs *u*, and outputs *y*. Figure (2) shows the simple block diagram for a cell *C*(*i*, *j*) [13].

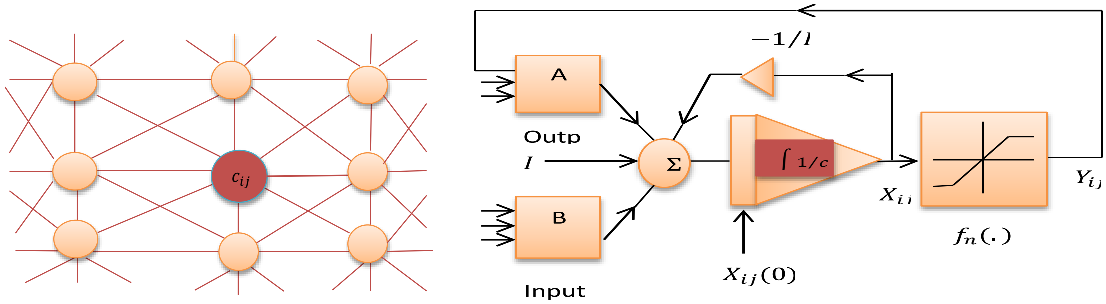


Figure (2) the left side is cell *C*(*i*, *j*) with its neighbored and the right side is cell block diagram

5. The Proposed System

At the beginning of this chapter, describing one of the proposed system goal to enhancing the performance Ad hoc and MANET wireless network because of their characters such as no preexisted infrastructure and high dynamic topology caused unpredictable change of their node as nodes enter and leave the network duo to broken routing links and packed lose, drop packed so it needed recalculate their broken routing links information; that cause consumes processing time, memory, Device power that introduce overhead traffic on the network and reduce network life time, Limited transmission range, Limited coverage area.

So this proposed system was design and implementation to avoiding some of these problems for these networks types by using different methods (Clustering and neural network) for get new adaptive routing algorithm for ad hoc and MANET wireless network (depending on the important role performance (routing delay, bandwidth, distance)). Using neural network to overhead of the control messages and find optimal path from source to distention.

Proposed approach: consists from using clustering algorithm and neural network for optimal path for the MANET network. There are two stages:

-clustering: apply the proposed new clustering algorithm called modified k-mean clustering algorithm to determined optimal cluster head and optimal number of cluster with their nodes.

optimal path: applying neural network to find the optimal rout from source to destination. Figure 3 shows the flow chart of the proposed system.

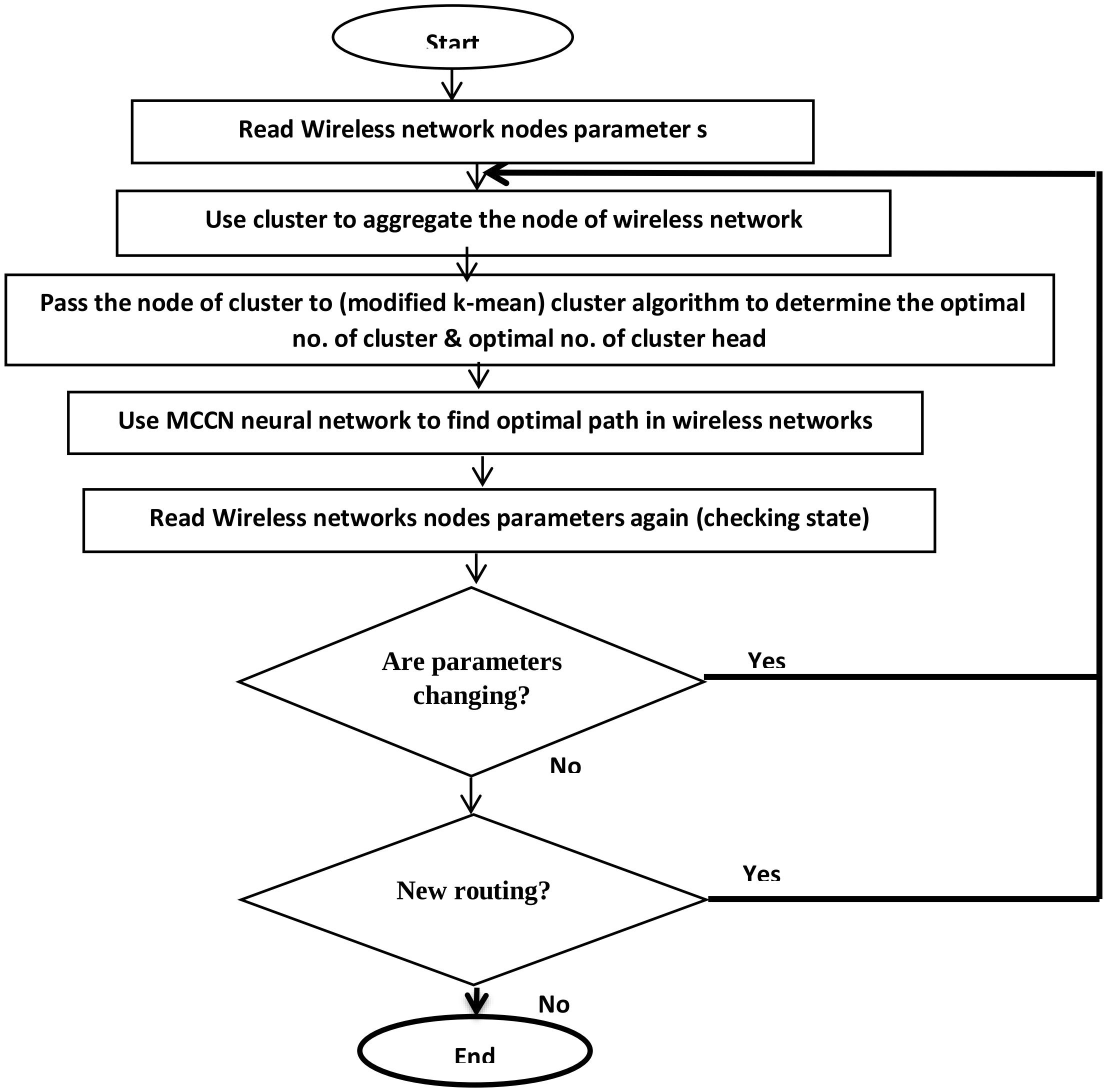


Figure 3: Flow Chart of Proposed System

6- The Proposed Modified Chaotic CNN (MCCN) for Optimal Path Finding

In this stage the Modified Chaotic CNN was used to find optimal path between two select point (nodes) in the wireless network. The proposed modifications are in two locations, the first modification in the CNN reduced topology method. In the [17], suggest an algorithm to reducing CNN nodes communication cost by clip the expensive neurons links that not effect of the network ability to retrieve stored memorize information's. Firstly, we suggest a modification for this algorithm (in [17]) by using the Ressler chaos system for make the connection reduction more affect and suitable for the routing purpose. Second proposed modification was used Ressler chaos system in the learning feeding of the CNN in order to increase the learning speed and get acceptable results in stable case by avoiding some the energy problem**.**

In general, the cellular neural network work as group of linked sub-networks by connection links. the links communication has endured costs, and information current through subnetworks with expensive costs compared to communications within same subnetworks. So, we try to minimizing links connections costs, whereas ensure the network operation and performance found incase certain threshold is above. Let the links connection cost were capture using weights of adjacency's matrices $\widehat{Sm}$. And the unweighted adjacency's matrices Sm, over the bi-polar memory's vector $\alpha^1,...\alpha^m \in B^n$, the operation is depending on the setting networks parameter T_{ij} (the network connection weight matrix) and b_i (bias's vectors of network) through their solution of generalized eigenvalue problem. The networks result maximize probability of patterns re-call, with costs effective less during use the networks operation in different connections.[17]

Then minimize the connectivity's of Sm, by deleting highest costs links specific by $\widehat{Sm}$, without affect memorizations qualities. the network links optimization helpful in balance between performance connection costs. In the particular pattern α^1 ...α^m must be saved in memory of network, with all nonnegative stabilities parameters $K_{i\mu}$ (for μ=1,…, m). the objective function value of the topology S links is as following:[17]

$$\overline{Ks} = \sum_{i=1}^{n} \sum_{\mu=1}^{m} K_{i\mu} \qquad (1)$$

where $\overline{Ks}$: stability parameters summation of all nodes for selected vectors of memory.

The stability parameters matrices K were used in many performance metrics, like absolute sums of the min rows element K (or columns. Let cost thresholds νs, and performances thresholds κs, the highest costs edges which elects for removing are selected in the "residual adjacency matrix" where M is the mean average of the costs in the neural network and Rc the Ressler chaos values were used as damper to the deletion operation and improve the selection of unhelpful links.

$$R = \frac{1}{2}\left(sign\left(\widehat{Sm} - vs * Sm\right) + M * Rc\right) \qquad (2)$$

where the signs functions are rated elements-wise on the arguments of matrix. Any elements in R have nonzero (i,j) value will remove all its associated (i,j) edges from (S). And the peaks costs edges related to highest's saved $\overline{Ks}$ values will deletion, and repeated this operation until no deletions form the Sm',$\widehat{Sm}'$.Algorithm 1 shows the reduction operation that we proposed to use in the Chaotic CNN in our proposed system. The second modification was used the Lorenz chaos system in the feeding of the CNN for optimization the speeding of the learning and detection of case to find the optimal path for two points in the wireless node. Figure 4 shows the modification of CNN cells by adding Lorenz chaos system in the feeding of network. In figure 4 of the feedback templates are stored for the previous cases for finding the optimal paths. The selecting the beast templates decreasing time of the selecting the optimal paths. Algorithm 2 shows the proposed MCCNN was sued in the proposed system.

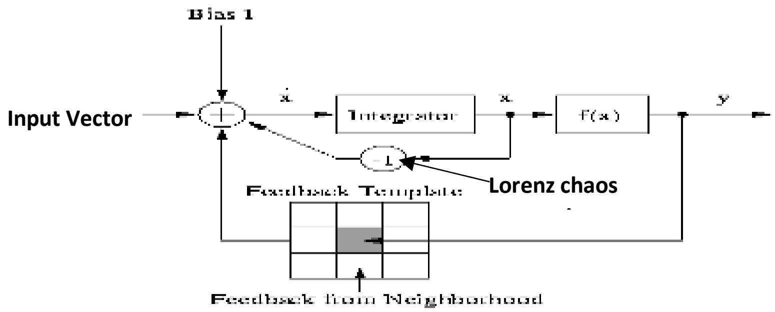


Figure 4 The modification of the CNN cell

<u>Algorithm 1 Chaotic CNN links Reduction</u>

```
Input: Matrices Sm, S̃m, α, vs, Rc and ks
Output: Matrix A of K̄s values for each removed edges.
Start:
Calculate M form K̄s.
R ←1/2(sign( S̃m – vs*Sm) + M*RC)
n ← row length(α)
m ← column length(α)
A ← [0] n×m
C ← [0] n×m
while max(R) ≠0 do
For each (i,j) such that R(i,j) ≠0, do
Sm'← {Sm: Sm(i,j) ← 0,Sm(j,i) ← 0}
Compute T and b, given Sm' and α (μ)
K̄s = Σ_{i=1}^{n} Σ_{μ=1}^{m} K_{iμ}
for μ = 1 to m do
for t = 1 to n do
α C(t, μ) ← α (μ) (Σ_{j=1}^{n} T_{tj} α^(μ) + b_t
end for
end for
if K̄s > κs ∧ minC > 1 then
A(i,j) ←K̄s ; A(j,i) ←K̄s
end if
R(i,j) ← 0; R(j,i) ← 0
end while
End.
```

Algorithm 2: the proposed MCCNN for finding optimal path

Input: patterns paths of nodes, m: clusters number, number of intra path p1, inter path p2, number of CH, α, ν, Rc(Ressler chaos), Lc(Lorenz chaos) and *k* و clusters size regions, packed size, (Dynamic or non-dynamic), link costs and bit rate.

Output: find the optimal path

Step1: Generate Matrices $S,\hat{S}$.

Step2: Initially the MCCNN (with cells M1,N = Number of rows and columns of the 2D CNN equal to the nodes number in the Wireless network), get the input parameters and, initial conditions and learned templates. Load the all paths information for the wireless networks clusters. And load best other wireless nodes parameters (clusters size regions, packed size, Dynamic or non-dynamic, link costs, and bitrate).

Step3. Initialize the weight vector Weight kept as fixed while the hidden to output weights are learned with minimum distance.

Step4: converge cells

while (converged-cells < total number of cells)

{for (i1=l; i1<=M1; i1++)

for (j1=l; j1<=N; j1++)

{if (convergences[i1] [j1]) continues; // the current cells was converged //

Step5: MCCNN reduction using algorithm 1.

Step6: Activate the cells and get Q from all paths results as the short path whose is minimum E_{i1j1} as Q = min(E_{i1j1}) that optimized by other wireless nodes parameters (clusters size regions, packed size, (Dynamic or non-dynamic), link costs).

Step 7: Calculate the next state using stored templates for the optimal path between p1 and p2.

$$x_{i1j1}(t+1) = x_{i1j1}(t) + \sum_{k,l\in N_{i1j1}} a_{k-i1,l-j1}\ f\big(x_{kl}\ (t)\big) + \sum_{k,l\in N_{i1j1}} b_{k-i1,l-j1}\ \big(u_{kl}\ (t)\big) - Lc + I$$

where $x_{ij:}$ the states of a cell at position(i1,j1),

$N_{ij:}$ the neighbors of the cell (i,j),

a_{kl} : the parameters of feedback templates (Links connection weights),

b_{kl} : the feedforward template parameters,

u_{kl}: the (time-invariant) input,

I: is a bias value.

the smallest's Euclidean's distances of B_{ij} will select:

$B_{ij} = Q \sum\sum_{j,i=1,2..m} \|p1-p2\|$

and optimized by other wireless nodes parameters (clusters size regions, packed size, (Dynamic or non-dynamic), link costs).

Step8: re-check the convergence criteria after the reduction operation.
If $\left(\frac{dx_{i1j1}(t_n)}{dt}\right) = 0, and\ y_{lk} = \pm 1, \forall c(k,l) \in N_r(i1, j1)$
{convergences[i1][j1] = 1;
convergedcells++ ;}   } /* end for loops */
Step9: Update the entire paths state values.
for (i1=l; i1<=M1; i1++) for (j1=l; j1<=N1; j1++)
{ if (convergences[i1][j1]) continue; $x_{ij}(t_n) = x_{ij}(t_{n+1})$; }
iterations++;} /* end while */
End

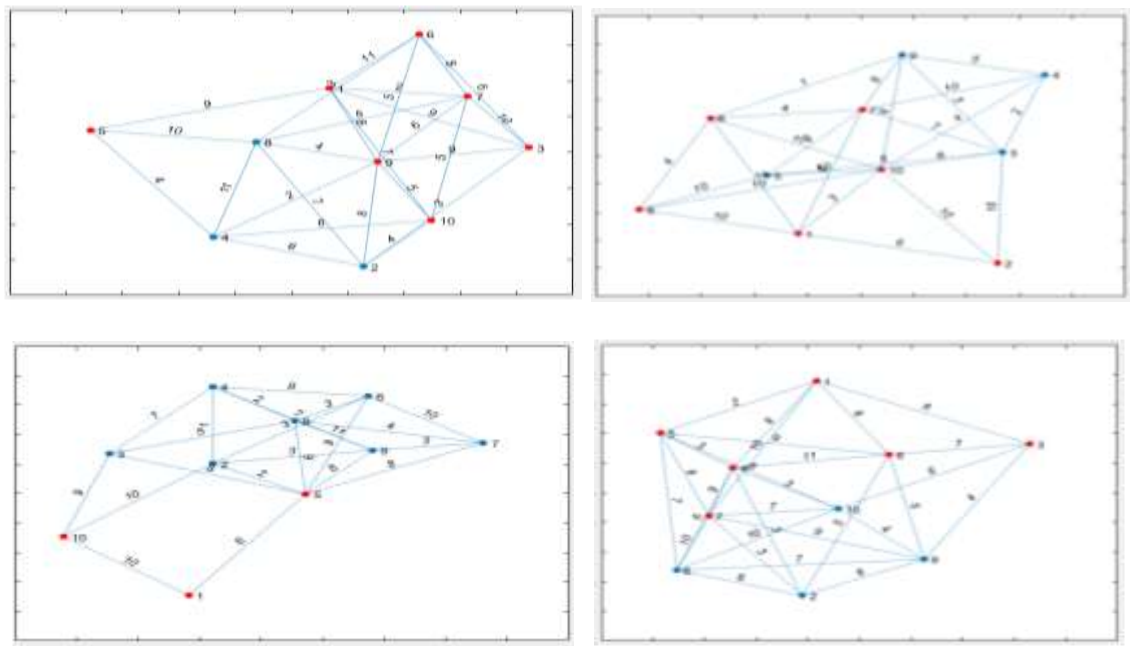
7. Results and discussion

In this proposed system there are two types of wireless topologies (fixed and dynamic) to test the proposed routing algorithms in different topologies and environments.

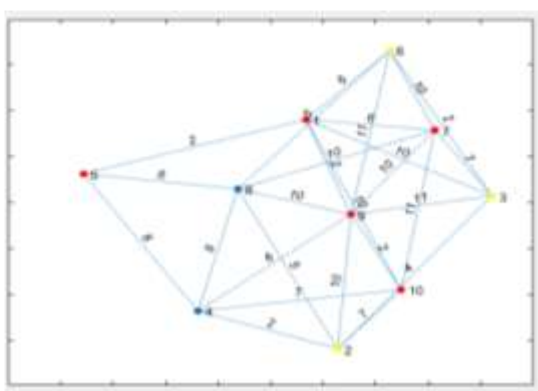
The proposed system can be worked in different types like Ad hoc network with different size (number of nodes). Dynamics topologies are mobiles ad-hoc network (MANET) with more than one mobile nodes are also tested. Mobiles ads-hoc network is design with facility of the scalability. When The networks grow, the traffics amounts of routings increase.

Many parameters are discovered in the wireless network are considered such as: number of nodes, shape and size regions, packed size, number of rounds, node distances, node link cost, wireless types, packet type(UDP), channels utilizations and networks sizes. These parameters determine the nodes abilities in MANETs to connect direct the sources and destinations.
In this case, we will test the proposed system routing and clustering proposed algorithms in ad hoc and MANET networks. The ad hoc wireless network has the following parameters as shown in table 1. Also, testing has two types of topology (fixed topology and mobile topology). The fixed topology is more simple from the mobile(dynamic) topology due the changing in the ad hoc nodes parameters like distance and nearness facility to the cluster centroid.

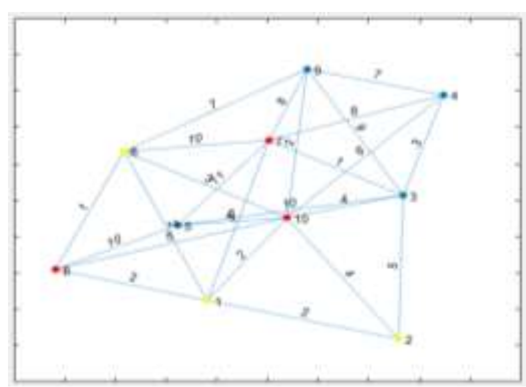
As shown in table 1, the bitrate random (between 1 kbs to 1Mbs) for all links in the network. The routing protocol depend on the proposed approach. In this approach we use the proposed modified neural network (MCCNN). Also, nodes links, and distances between nodes are randomly distributed. The network has size of 10 and 50, nodes in the virtual region with maximum area 2km with random distribution. Figure 5 shows the selected ad hoc networks for 10 nodes with results of clustering and routing. Figure 6 shows the selected ad hoc networks for 50 nodes with results of clustering and routing. Tables(1-4) show the clustering results for the proposed system algorithms in different cases of wireless networks.



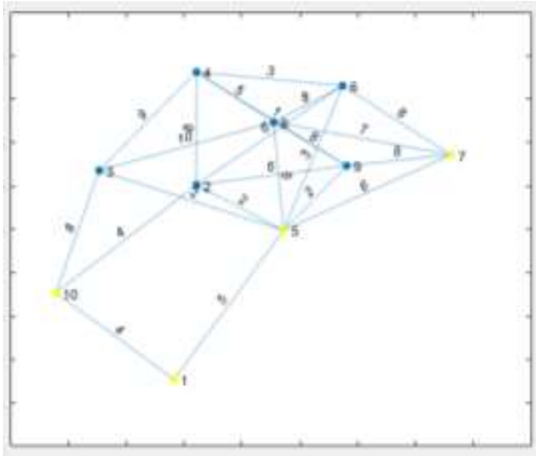
a)The results of applying clustering on the ad hoc samples (10 nodes).

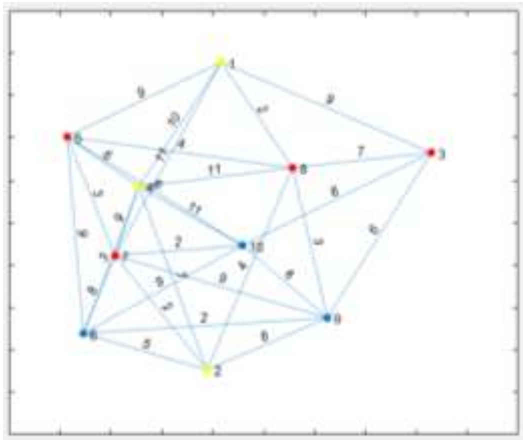


Optimal path between (2-6) nodes



Optimal path between (2-6) nodes





Optimal path between (7-10) nodes **Optimal path between (1-2) nodes**

b)The results of applying routing on the ad hoc samples (10 nodes).

Figure 5 The four ad hoc samples (10 nodes) for testing proposed system with clustering and routing results

Table 1 The proposed system routing results for 10 nodes (fixed topology).

Samples	Dijkstra Time(avg.)	MCCNN time(avg.)	Avg. bitrate(kbs)	Avg. links costs	Avg. Distance	Avg. No. hops
Net1	0.41328	0.09101	1-100	1-10	1-10	3
Net2	0.41677	0.09110	1-800	1-10	1-10	3
Net3	0.41638	0.09210	1-1000	1-10	1-10	3
Net4	0.41767	0.09165	1-1000	1-10	1-10	3

Table 2 The proposed system routing results for 10 nodes (one-two nodes mobile).

Samples	Dijkstra Time(avg.)	MCCNN time(avg.)	Avg. bitrate(kbs)	Avg. links costs	Avg. Distance	Avg. No. hops
Net1	0.60893	0.11065	1-100	1-14	1-12	3
Net2	0.61071	0.11074	1-800	1-14	1-12	3
Net3	0.61189	0.11076	1-1000	1-14	1-12	3
Net4	0.62839	0.11082	1-1000	1-14	1-12	3

Table 3 The proposed system routing results for 10 nodes (three nodes mobile).

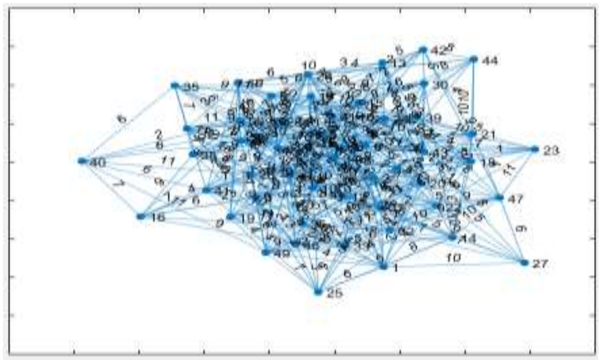
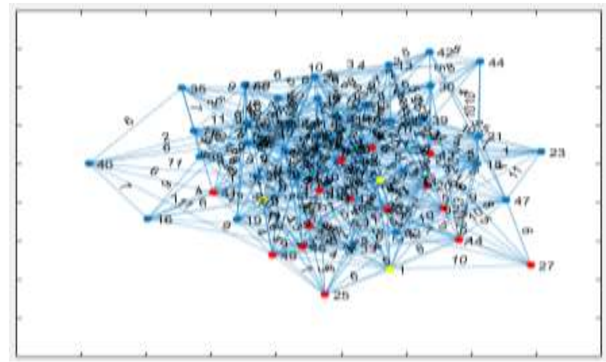
Samples	Dijkstra Time(avg.)	MCCNN time(avg.)	Avg. bitrate(kbs)	Avg. links costs	Avg. Distance	Avg. No. hops
Net1	0.92111	0.32053	1-100	1-16	1-15	4
Net2	0.92201	0.32098	1-800	1-16	1-15	4
Net3	0.92288	0.32126	1-1000	1-16	1-15	4
Net4	0.92376	0.32145	1-1000	1-16	1-15	4

Table 4The proposed system routing results for 10 nodes (five nodes mobile).

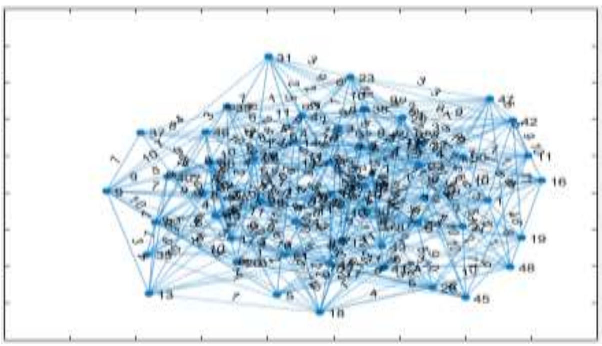
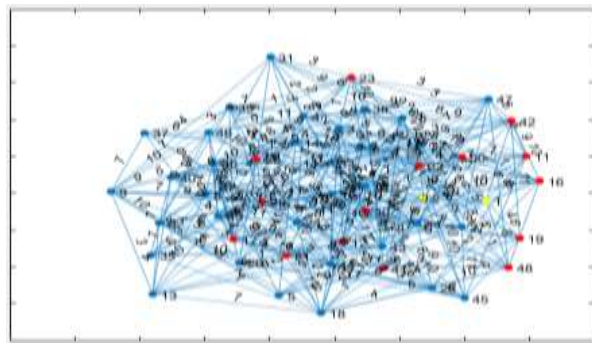
Samples	Dijkstra Time(avg.)	MCCNN time(avg.)	Avg. bitrate(kbs)	Avg. links costs	Avg. Distance	Avg. No. hops
Net1	1.52985	0.50120	1-100	1-19	1-17	4
Net2	1.54453	0.50252	1-800	1-19	1-17	4
Net3	1.55190	0.50311	1-1000	1-19	1-17	4
Net4	1.57340	0.50321	1-1000	1-19	1-17	4

From the above routing tables, the Dijkstra method take big time comparing with the proposed method. The mobility effect (in MANET) on the Dijkstra method more than the proposed method. The ratio of average routing time of the MCCNN over Dijkstra (in table 4 for five nodes mobiles) is= 1.56708/0.50251=311% speeding up more than Dijkstra method. The ratio different between the fixed topology ad hoc (table 1) and MANET with five mobile nodes (table 4) are: MCCNN ratio=0.50251/0.09337=538% increase in time. Dijkstra =1.56708/0.41602=376.6% increase in time.

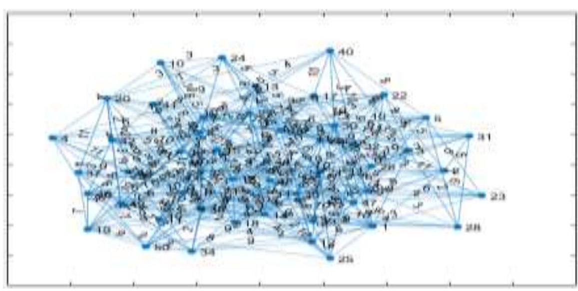
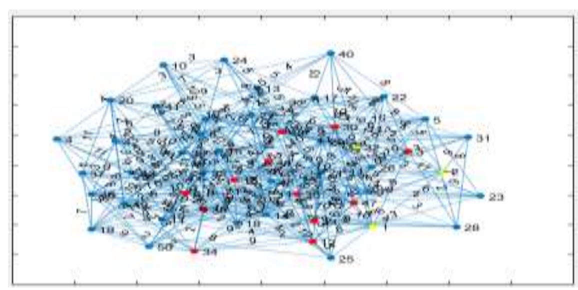
Now, the other network size testing, we use the 50 nodes ad hoc and MANET configuration. A 4 samples are selected randomly to be used in the testing the proposed system as shown in figure6.

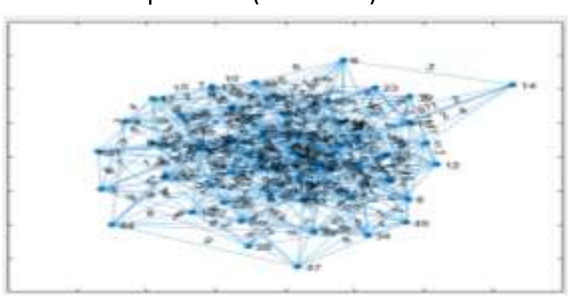
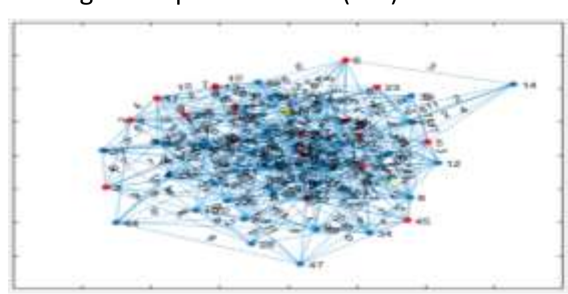
Sample net1 (50 nodes) Routing Result path between (1-2) nodes

Sample net2 (50 nodes) Routing Result path between (1-2) nodes

Sample net3 (50 nodes) Routing result path between(1-2) nodes

Sample net4 (50 nodes) Routing Result path between (1-2) nodes

Figure 6 The second Example of 4 samples (50 nodes) for testing the proposed system

Tables (5-8) show the routing time results and comparison.

Table 5 The proposed system routing results for 50 nodes (fixed topology).

samples	Dijkstra Time(avg.)	MCCNN time(avg.)	Avg. bitrate(kbs)	Avg. links costs	Avg. Distance	Avg. No. hops
Net1	1.15421	0.27210	1-100	1-10	1-60	10
Net2	1.15488	0.27240	1-800	1-10	1-60	10
Net3	1.15520	0.27255	1-1000	1-10	1-60	10
Net4	1.15531	0.27287	1-1000	1-10	1-60	10

Table 6 The proposed system routing results for 50 nodes (one-two nodes mobile).

samples	Dijkstra Time(avg.)	MCCNN time(avg.)	Avg. bitrate(kbs)	Avg. links costs	Avg. Distance	Avg. No. hops
Net1	1.24782	0.31960	1-100	1-15	1-70	12
Net2	1.24883	0.31985	1-800	1-15	1-70	12
Net3	1.24982	0.32076	1-1000	1-15	1-70	12
Net4	1.24990	0.32110	1-1000	1-15	1-70	12

Table 7 The proposed system routing results for 50 nodes (three nodes mobile).

samples	Dijkstra Time(avg.)	MCCNN time(avg.)	Avg. bitrate(kbs)	Avg. links costs	Avg. Distance	Avg. No. hops
Net1	1.53261	0.67626	1-100	1-20	1-75	14
Net2	1.53290	0.67641	1-800	1-20	1-75	14
Net3	1.53299	0.67700	1-1000	1-20	1-75	14
Net4	1.53310	0.67798	1-1000	1-20	1-75	14

Table 8 The proposed system routing results for 50 nodes (five nodes mobile).

samples	Dijkstra Time(avg.)	MCCNN time(avg.)	Avg. bitrate(kbs)	Avg. links costs	Avg. Distance	Avg. No. hops
Net1	2.23675	0.89290	1-100	1-23	1-80	18
Net2	2.23690	0.89301	1-800	1-23	1-80	18
Net3	2.23734	0.89313	1-1000	1-23	1-80	18
Net4	2.23780	0.89327	1-1000	1-23	1-80	18

As shown in the tables above, the time is relationally increase with increase the nodes and links. Any mobile node moves from their location make the routing algorithms spend more time to determine the optimal path if the path pass through it. The average time of Dijkstra method (in the worst case move five nodes in MANET)= 2.23719, and MCCNN= 0.89307. The different time between the Dijkstra and MCCNN is 250.5%.

Conclusions

As shown from the results and ratios, the proposed routing algorithms are more speed and efficient than the Dijkstra method. The proposed routing methods less than effect by increasing the ad hoc nodes and links than the Dijkstra.

Because the performance of selecting the optimal paths and speeding this selection by using our proposed system, the throughput of the network will increase and the life time of nodes and connection become more useful. Also, the packet delivery ratio will increase because the optimal path has the best parameters from other paths including the best bitrate and best life link with minim delays.

References

1. Navpreet Kaur, Sangeeta Monga " Comparisons Of Wired And Wireless Networks: A Review" Kaur et al., International Journal of Advanced Engineering Technology,2014.
2. Subir Kumar Sarkar, T G Basavaraju , C Puttamadappa" Ad Hoc Mobile Wireless Networks Principles, Protocols, and Applications" International Standard Book Number-13: 978-1-4200-6221-2 (Hardcover), Auerbach Publications Taylor & Francis Group, 2008 by Taylor & Francis Group.
3. Vanita Rani PG Student, Dr. Renu Dhir" A Study of Ad-Hoc Network: A Review" International Journal of Advanced Research in Computer Science and Software Engineering, 2013.
4. Heni Kaaniche and Farouk Kamoun" Mobility Prediction in Wireless Ad Hoc Networks Using Neural Networks" Journal of Telecommunications, Volume 2, Issue 1, April 2010.
5. Siddesh.G.K, K.N.Muralidhara, Manjula.N.Harihar" Routing in Ad Hoc Wireless Networks using Soft Computing techniques and performance evaluation using Hyper net simulator" International Journal of Soft Computing and Engineering (IJSCE) ISSN: 2231-2307, Volume-1, Issue-3, July 2011.
6. Seyed Saeed Sadat Noori , Seyed Ali Sadat Noori, Seyed Morteza Lari Baghal "Optimization of Routes in Mobile Ad hoc Networks using Artificial Neural Networks" international Journal of Soft Computing And Software Engineering (JSCSE) e-ISSN: 2251-7545 Vol.2,No.4, 2012.
7. Parimal Kumar Giri, Member,IACSIT "A Survey on Soft Computing Techniques for Multi-Constrained QoS Routing in MANET "IJCIT, ISSN 2078-5828 (Print), ISSN 2218-5224 (Online), Volume 03, Issue 02, Manuscript Code: 130103 ,2012.

8. S. Gangwar, K. Kumar & M. Mittal "Cluster Head Selection in Mobile Ad-hoc Network (MANET) Using ART1 Neural Network" African Journal of Computing & ICT, Vol 8. No. 1 – March, 2015.
9. Parul Gupta "A Literature Survey of MANET "International Research Journal of Engineering and Technology (IRJET) Volume: 03 Issue: 02 | Feb-2016
10. Bharath Chandra Mummadisetty, Astha Puri, Shahram Latifi " Performance Assessment of MANET Routing Protocols " Department of Electrical & Computer Engineering, University of Nevada, Las Vegas, USA, nt. J. Communications, Network and System Sciences, 2015.
11. Ilya Grigorik "High Performance Browser Networking what every web developer should know about networking and web performance" EBook، Publisher: O'Reilly Media Final Release Date: September 2013.
12. Abdelhak Bentaleb1, Abdelhak Boubetra1, Saad Harous "Survey of Clustering Schemes in Mobile Ad hoc Networks" Department of Computer Science, University of Bachir el Ibrahimi, Bordj Bou Arreridj, Algeria Communications and Network, 2013.
13. Jeferson Wilian de Godoy Stênico, Lee Luan Ling, " Topology Control for Ad-Hoc Networks: A Comprehensive Review for Table Driven and On-Demand Routing Protocols " Communications and Network, 2013.
14. Parvinder Kaur, Dr. Dalveer Kaur & Dr. Rajiv Mahajan" The Literature Survey on Manet, Routing Protocols and Metrics" Global Journal of Computer Science and Technology: E Network, Web & Security Volume 15 Issue 1 Version 1.0 Year 2015.
15. Anju Sharma, Shini Agarwal and Ravindra Singh Rathore" Cluster Based Routing in Mobile Ad hoc Wireless Networks Using Neuro-Genetic Paradigm " International Journal of Scientific & Engineering Research Volume 3, Issue 7, July-2012 ISSN 2229-5518.
16. . Jerusha, K.Kulothungan & A. Kannan" Location Aware Cluster Based Routing In Wireless Sensor Networks" International Journal of Computer & Communication Technology ISSN (PRINT): 0975 - 7449, Volume-3, Issue-5, 2012.
17. Bhambhani, Varsha; Tanner, Herbert, "Topology Optimization in Cellular Neural Networks", Department of Mechanical Engineering, University of Delaware, 2010-07