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Base Station Positioning in Wireless Networks Using Self-Adaptive Particle Swarm Optimization Approach

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ABSTRACT
Mobile networks have attracted substantial interests in latest years due to their improved flexibility and decreased expenses. Wireless networks may be deployed in regions without a pre-existing stressed out-conversation infrastructure or where it's far Ad-hoc channels allows them ideal along with military operations for an comprehensive range of programmes, rescue and law enforcement organizations as well as in earth disorder recovery situations. Broadcasting is essential in an ad hoc network for statistics dissemination. Flooding of messages from a source to all other nodes in the network is known as broadcasting. The most significant parameters in WSN concerned for cluster head selection are energy, delay and distance. In fact, clustering scheme is exploited to extend the lifetime of the sensor network by reducing the energy consumption of the network as well as increasing the stability of the network. Thus the main aim of the SAPSO base station clustering approach is to group the sensor nodes and gather the data together to transmit. Clustering has additionally developed as a vital studies topic in Ad-hoc networks given that it could enhance the system performance by using lowering the consumption of battery strength. Cluster-based full Routing additionally limits the quantity of routing information that propagates inside the network. The main problem of the Ad-hoc wireless system was Node discovery, depends upon the antenna we are using the packet delivery ratio will varies. In wireless system that sensors are generally powered by the batteries, usually battery provides lesser amount of power only. Also recharging and replacing of that batteries also very difficult in real-time. Efficient usage of packet delivery ratio will leads to the improvement in the energy efficiency of the system.

Key words: Ad-hoc, Base station, Cluster, Wireless Networks.

1. INTRODUCTION

In this Section, a novel Self-Adaptive Particle Swarm Optimization (SAPSO) algorithm is proposed for solving the coverage problem [1]. SAPSO algorithm is used for the storage problem from communication [2]. This might decrease the energy governing endurance should be heightened enormously. By performing SAPSO method distance, optimizations for delays, robust security and some other performance [3]. SAPSO is modified only after some methods such as GA, FFDUP and ABC-DS are compared [4].

In order, many research funds are made to address or solve the difficulty in the positioning system. In the endurance of network and flexibility is raised by adopting the LEACH method [5]. The main limitation of using this LEACH method it cannot allow cluster communication [6]. The greedy algorithm is possibly called for its high adeptness, union and ease of nature [7]-[10]. When it comes to complexity greedy algorithm is incompetent in nature. The use of dynamic source routing is adapted for degradation in overhead control, and moreover it depicts the process in lag position. The determinate design embraced in reveals the consistency of the decision with great versatility. The unworkable place for the base station is complex when the real algorithm came into the process. WLS method shows some of its merits such as multi functionality, accuracy and adeptness [11]-[15]. To obtain the sub optimal solution dynamic programming was adapted but principle of optimality is not met. The GA can find the location of its BS positioning. Although this literature discusses the selfish approach and the evolutionary approach [16]-[18].

The enormous quantity of water washed out every day in house, business and etc. In the majority of water waste owing to pipeline leak, usual pipeline structure leak might simple to discover but subversive pipeline leak not simple to discover equated to usual pipeline method. In usual leak roughly 4000 fall of water exhausted in pipeline that is identical to one liter. The important aim of this method is minimize the waste of water as well as preserves the water to after generations [19] Generally, adult people can evade any communication by healthcare establishments like treatment house as well as hospitals. A smart setup is used to check human characters via accelerometer, pulse. Multilayer Neural Network is used an alert method to the individual care helper, to observe the data utilizing dissimilar education methods [20].

2. PROPOSED SYSTEM MODEL

2.1 Layout structure of Base station

The existence or purpose of this study is to describe B_S layout. Layout of primary station positioning is shown in Fig. 3.2.This correspond is mainly passed down to reduce range among CH and BS. Based on fitness function range among CH and BS obtained. From Equation(1) used for the basis of the objective layout of Equation (2).

$$f_i = \frac{1}{P} \quad (1)$$

$$P = \sum_{i=1}^{c} \frac{n \times d}{\sqrt{Area}} \quad (2)$$

where,
n-Amount of Group Nodes,
d-range between CH and BS
C- Amount of clusters.

The implemented algorithms SAPSO can be handed to overcome the architecture design which is substantially vary of PSO to produce recession weights. Also, SAPSO is used to find out the mass based on the magnitude of the granular activity exhibited by the particles. The method known GA is entirely changes from the Proposed SAPSO. It exhibits a speed-based refresh which find the position of the base station. It will update process merges quicker than the existing method of algorithms.

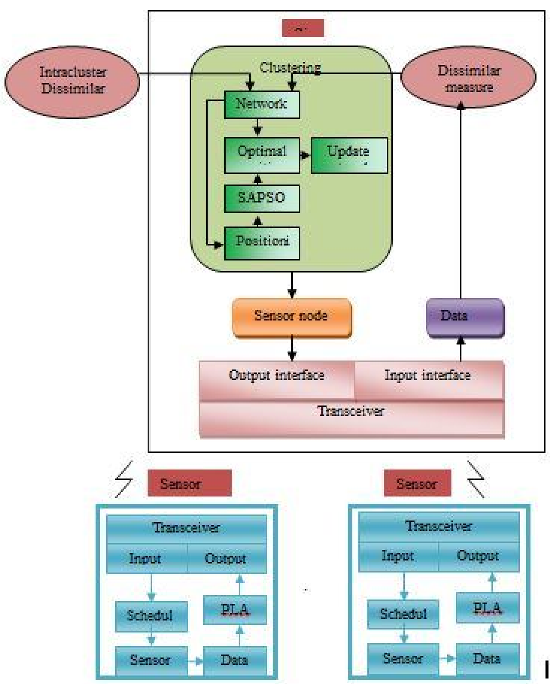

Figure 1: Base station positioning layout

3. PROPOSED ALGORITHM

In this proposed SAPSO method is used to sustain the mechanism with inertia mass. The proposed SAPSO method boots up specific range of the search space for a random group of particles. To get a correct result on a random screen, each substance displays a corresponding training attribute& a solution points. The group of particles distributed of d dimensional space in a n atom. Particulate location & velocity at iteration $Y_p^{(i)} = (y_{p_1}, y_{p_2}, \ldots, y_{p_d})$ and $Z_p^{(i)} = (z_{p_1}, z_{p_2}, \ldots, z_{p_d})$ .The safest place for particles is $O_p^{(i)} = (o_{p_1}, o_{p_2}, \ldots, o_{p_d})$ and $O_g^i = (o_{g_1}, o_{g_2}, \ldots, o_{g_d})$ its comes out as O_f &The highest status the entire population has reached so far is known as O_g .Equation (3) shows position of the p^{th} particle for second execution and velocity.

$$Z_{id}^{(i+1)} = x_p^{(i+1)} * Z_{pd}^{(i)} + t_1 * f_1^{(i+1)} * (O_{pd}^{(i)} - O_{pd}^{(i)}) + t_2 * f_2^{(i+1)} * (O_{gd}^{(i)} - O_{id}^{(i)}) \quad (3)$$

Where,

t_1 - social acceleration constant (coefficient)

t_2 - constant of acquiring phase

$f_1^{(i+1)}$ and $f_2^{(i+1)}$ Variable feature within a span of[0, 1].

$x_p^{(i+1)}$ describes Particulate momentum component at iteration.

Strength of the recession will be updated until the best solution for each iteration is reached and it is represented in Equation (4).

$$Y_{pd}^{(i+1)} = Y_{id}^{(i)} * Z_{pd}^{(i+1)} \quad (4)$$

Algorithm 3.1:Pseudo code.

Input: t_1 & t_2
Output: Optimal cluster head
START

Stage I: load each p^{th} particle in population and no. of particles $X_p^{(i)}$ and $Z_p^{(i)}$ & calculate r .

Stage II: Initialize $O_p^{(i)}$ and $O_g^{(i)}$; $\forall_p \leq n$

Stage III: $x_p^{(i)} = 0;$

Stage IV: While (if I is false, termination condition is reached) $i = 0$

Stage V: For $p = 0$;number of particles and $d = 1$; number of dimensions;

$$Z_{id}^{(i+1)} = x_p^{(i+1)} * Z_{pd}^{(i)} + t_1 * f_1^{(i+1)} * (O_{pd}^{(i)} - O_{pd}^{(i)}) + t_2 * f_2^{(i+1)} * (O_{gd}^{(i)} - O_{id}^{(i)})$$

Stage VI: Check the velocity extent

$$Y_{pd}^{(i+1)} = Y_{id}^{(i)} * Z_{pd}^{(i+1)}$$

Stage VII: If $(r(Y_p^{i+1}) < r(O_p^{(i)}))$ For $i = i+1$; $O_p = Y_p^{(i+1)}$

Stage VIII: If $(r(Y_p^{(i+1)}) < r(O_g^{(i)}))$ $O_g = Y_p^{(i+1)}$

Stage IX: Modify ∂_p by utilizing Equation (5) & x_p by Equation (6).
STOP

Equation 5 explains self-adaptive inactivity.

$$x_p^{(i+1)} = x_p^{(i)} \left| f_p^{(i+1)} * (x_p^{(i)} - x_p^{(i)}) * \partial_p^{(i+1)} \right| \quad (5)$$

where,

$f_p^{(i+1)}$ denotes random variables distributed homogeneously between span of(0,1) at execution $(i+1)^{th}$

$r(Y_p^{(i-1)})$ In iterations I - denotes the fitness function of particle p .

$r(Y_p^{(i)})$ denotes wellness function of a p^{th} entity in executions (i-1) .

Equation 6 ∂_p^{i+1} gives the soul-adaptive replication ratio

$$\partial_p^{(i+1)} = \frac{r(Y_p^{(i-1)}) - r(Y_p^{(i)})}{r(Y_p^{(i-1)})} \quad (6)$$

4. RESULTS AND DISCUSSION

Using MATLAB R2015a detailed simulation is performed for SAPSO method for analytical purposes. Performance analysis is determined by examining energy adeptness with and without primary station positioning..

Table 1: The simulation specification for the SAPSO

Vector	Definition
∂_p	Self-adaptive ratio
O_g	Whole population position
O_f	Best particle location
r	wellness function or fitness function
Y_p	Particle Velocity
x_p	Momentum factor
Z_p	Location of particles
f_1, f_2	Random function
t_1, t_2	Positive constants
P	Particle

Table 2: Parameters

Parameters	Value
Initial energy node	0.5 J
Node distribution	Random distributed
Node number	100
Network size	$100m \times 100m$

4.1 Convergence analysis

Following graph of the PSO & the suggested SAPSO is obtained by using the fitness function, and shown below in Figure 2 Right now.

Comparison is made with some of the current algorithms to find the efficient or high output configuration of the primary unit SAPSO. This implementation is referred from [21] for comparison in simulation results. Simulation parameters and codes utilize in this method are described in Table 1 and 2

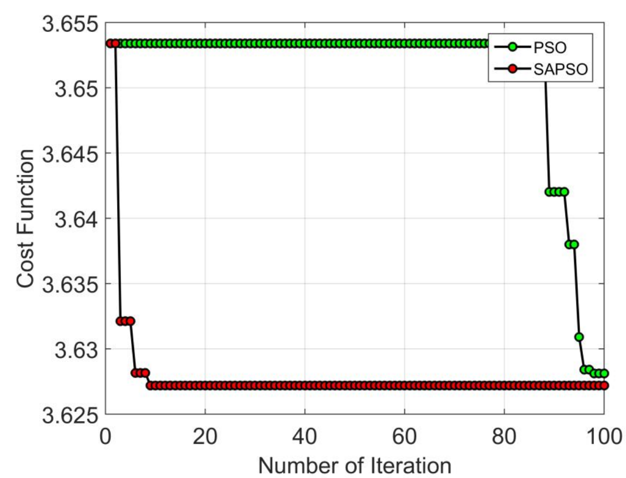

Figure 2: Cost function vs number of iteration

Figure 2 offers cost relation versus number of iteration taking into account the standard GA, PSO and suggested SAPSO process. SAPSO has the highest consistency rate as opposed to traditional system. In GA mode the cost function remains unchanged in 3.73 through 0 to 85 iterations. The cost function of the PSO is likewise unchanged between 0 to 80 operations in 3.72.The suggested SAPSO's price factor is decreased to 60 iterations to 3.75 and the iteration remains unchanged from 100 to 100.The reliability of the suggested algorithm over cost feature is 80 percent and 21 percent compared to GA and PSO.

Table 3: Parameters Analysis

STATISTICS	GA	PSO	SAPSO
Mean	3.7027	3.702	3.7009
Median	3.7003	3.7003	3.7003
Best	3.7003	3.7003	3.7003
Worst	3.7129	3.706	3.706
Standard Deviation	0.00429	0.002774	0.001816

Table shows some of the statistical results such as Mean, Median, Standard Deviation, Best and Worst for ordinary and outlined method is summarised. As shown in Figure 2, Compared with the conventional method SAPSO has long term acquisition.

4. 2 Base station positioning from LEACH

Segment includes LEACH technique review with baseline location. It's popularly known for hierarchical configuration to inhibit the energy consumption of the network. Nonetheless, it doesn't verify any data about the Core of the WSN unit. Cluster heads are randomly picked. That's why cluster head distribution and optimum number cannot be verified. Data will not reach the base station if the cluster head is destroyed and thus it becomes ineffective. Energy adeptness of LEACH method is shown in below Figure 3. In order to calculate the energy efficiency of a network, the total numbers of alive nodes are calculated for each round. Figure 3 and 4 show that the LEACH technique generates fewer efficiency gains and reduces live node numbers.

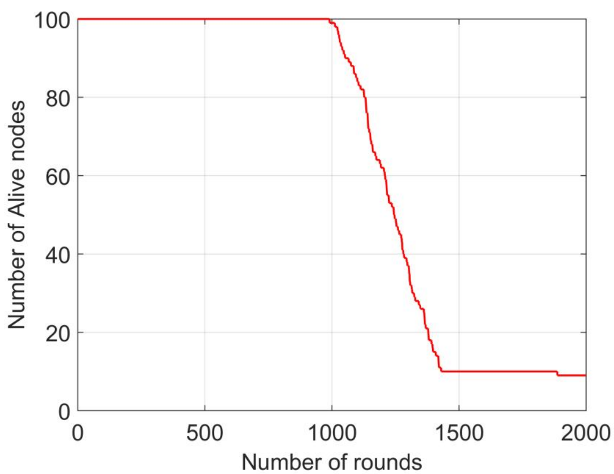

Figure 3: No of Alive nodes Vs. No of rounds

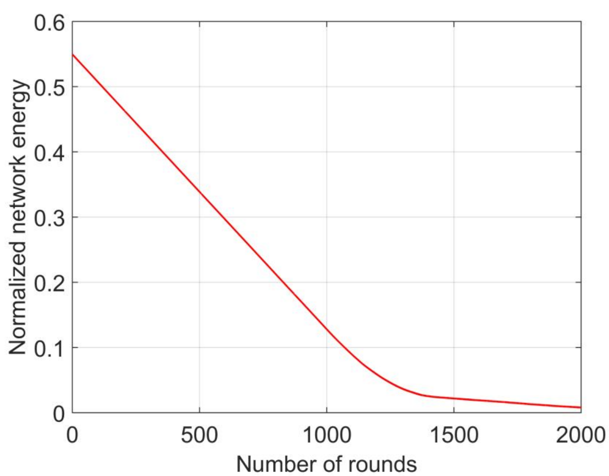

Figure 4: Normalized network energy Vs. No of rounds

4.3 Positioning of base station on CHS platform

Segment demonstrates comparison of the new SAPSO with the standard node position algorithms. Figure 5 Graphical representations of No of Alive nodes vs. No of rounds.

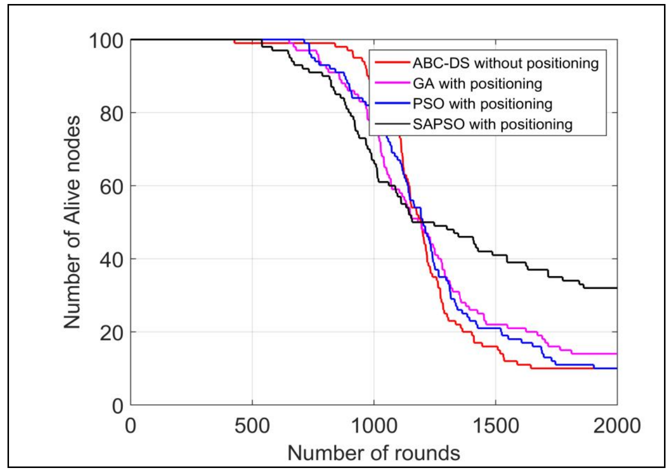

Figure 5: CHS device with node positioning on live entities scale, capacity and latency

Figure 5 Review of the suggested framework & traditional methods based on range, fuel and latency is presented. No live nodes are found to be that for all over 1400 loops of approaches. And for every 1400 to 2000 rounds our proposed system (i.e.,) SAPSO shows efficient performance. Figure demonstrates 90 percent better live nodes in SAPSO than traditional GA algorithms.

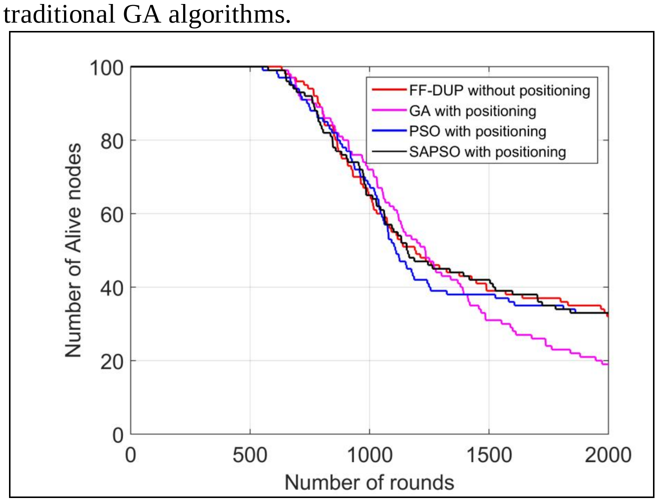

Figure 6: Represents the CHS architecture with Base Network's alignment in form of active safety nodes.

Figure 6 clear that, for both traditional and proposed approaches, no live nodes are the same. The proposed SAPSO approach would be marginally higher in 2000 than the traditional Algorithm ABC-, GA, FF- and PSO. The proposed SAPSO approach is found to be a network's maximum lifetime in terms of estimation & outperforms all the traditional methods.

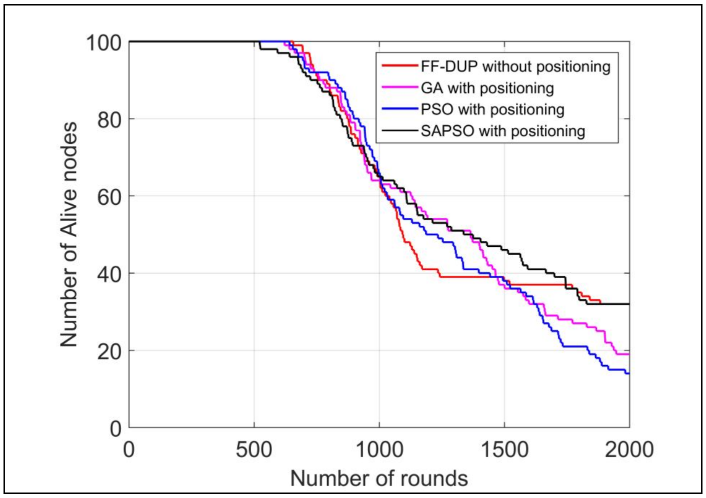

Figure 7: Shows the graphical representation of GA, PSO and SAPSO with positioning and FF-DUP without positioning

Figure 7 shows the proposed model could subsist around 37 Form of entities alive, before 2000 rounds. And it is very clear that the indicated SAPSO is 80 per cent better compared to the GA form.

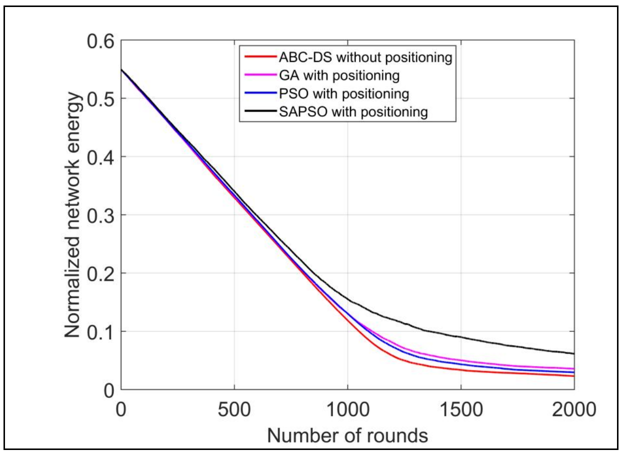

Figure 8 : Comparative scrutiny of the proposed algorithm against existing algorithms.

Figure 8 shows the comparison of the suggested study with normalized network over 100 nodes. Whereas, the network energy is the same for both the planned architectures and current ones. As mentioned above the SAPSO is found to be better at round 800.It is quite clear that the SAPSO is efficient network energy over existing all the other methods such as PSO, GA and ABC-DS.

Figure 9 is Qualitative graphical study of suggested study versus traditional methods over 100 nodes over normalized network energy. When it comes from 100 – 700 rounds all the methods seems to be same whereas between 500 – 1800 PSO and SAPSO correlate with one other. SAPSO also delivers optimum capacity in the network compared to traditional methods. Finally, we conclude with the fact that proposed method is 80% better than existing algorithm FF-DUP algorithm.

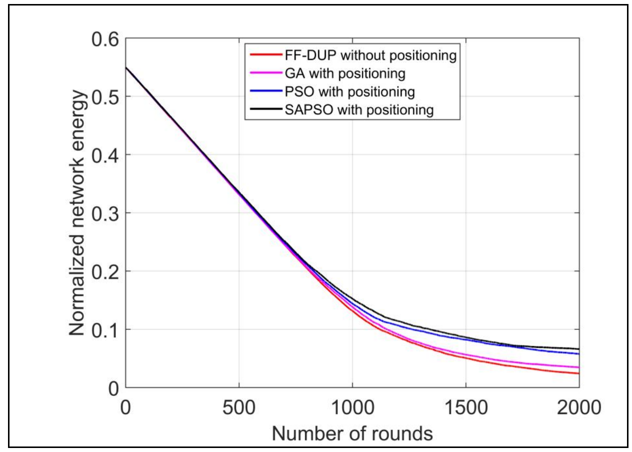

Figure 9: Standardized network energy versus no rounds on safety

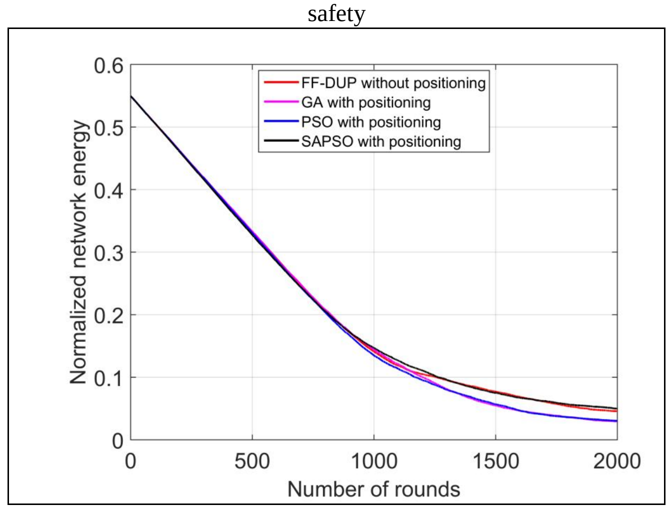

Figure 10: Standardized energy network vs no of nodes in terms of effectiveness, range, power and latency.

Figure 10 demonstrates regular network energy for 100 nodes. This survey shows that the suggested SAPSO performs 10 percent above the proposed system.

5. CONCLUSION

The base station's exact location or location enables the Wireless sensor networks to have a direct effect on the lifetime. Therefore, a SAPSO algorithm was developed for the Wireless Sensor Network to use fitness feature to gather the optimum location for the base station. The main aim here was to reduce gap among ground station and group head to extend life of a wireless sensor network. And also the power, latency, and range levels were assessed on the output of the planned SAPSO. Additionally, the suggested method has been cross checked with some other current algorithms. Furthermore, the total amount of active points and the channel power were determined on the basis of efficient location of the ground station to show the difference of the suggested system with current process. The finding shows output efficiency & performance of the SAPSO for maximizing the existence of a wireless sensor network.

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