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Research on Ebola Virus Prorogation Prediction based on Polymorphic Ant Colony Algorithm

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Abstract: The Ebola virus is a highly infectious and rare virus. In order to control the further spread of the Ebola virus, make the vaccine efficiently and quickly transport to the hardest hit by the disease, reduce constantly the number and scale of the Ebola epidemic, and ultimately control the spread of the virus, we use the shortest path to solve this problem. First, the model of shortest path problem is established. Then the polymorphic ant colony algorithm is applied to accomplish shortest path problem. Finally, it is showed in the simulation experiments that the PACA can reasonable to solve shortest path problem in Ebola virus prorogation, and it has a great advantage in search time, convergence speed, and optimization result and algorithm efficiency.

Keywords: Ebola Virus; Shortest Path; ant colony algorithm; polymorphic ant colony algorithm

1. INTRODUCTION

The Ebola virus is a highly infectious and rare virus [1]. Discovered its existence in southern Sudan and the Congo (DRC) (formerly Zaire) the Ebola River in 1976 which caused widespread concern and attention of the medical field, the name of "Ebola" is created. Ebola is a virus of the high mortality rate that is up to 90%.

2014 Ebola outbreak [2] in West Africa is a large-scale virus outbreaks began in February. As of December 2, 2014, World Health Organization declared Guinea, Liberia, Sierra Leone, Mali the United States as well as Nigeria, Senegal and Spain that the epidemic has ended had appeared cumulative confirmed, probable, and possible Ebola infections 17,290 cases, of which 6128 people died. As of December 17, 2014, the World Health Organization (WHO) published data that the cases of Ebola infection (including suspected cases) of Liberia, Sierra Leone and Guinea in West Africa Ebola has reached 19,031 people, including the dead toll reached 7373 people. On February6, 2015, World Health Organization published data that Guinea, Liberia and Sierra Leone of the Ebola harder-hit area found cumulative suspected, possible or confirmed 22,525 cases of Ebola, 9004 people died.

As it is shown in Figure 1, we have got some Ebola virus data from March 2014 to December published by the World Health Organization (WHO) [3]. From the figure 1, we can see that the total number of Ebola infections increase slightly from March to July. However, the total number increases rapidly from July to December.

Faced with such huge numbers, the solution of Ebola should take immediate action. If there is no effective drug control measures and the epidemic will continue to spread it, and spread to the whole world. We build a model based on polymorphic ant colony algorithm to determine the optimal locations of delivery. By the experiment, we find our model can work well, they can help government forecast the epidemic spread, and can save a lot of resource.

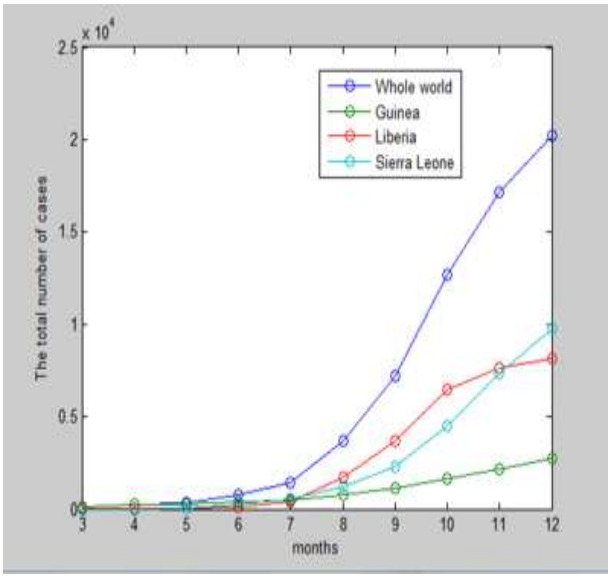

Figure 1. cumulative number of Ebola virus

We take the problem of determine the optimal locations of delivery medicines to shortest path problem. Shortest path problem is a typical combinatorial optimization problem. The ant colony algorithm has excellent properties of robustness, self-adaptation, parallelism, and positive feedback, it is suitable to solve some complex combinatorial optimization problem. In this paper, we adopt the polymorphic ant colony algorithm to solve the shortest path problem.

The rest of this paper is organized as follows: Section 2 lists some related work. Section 3 describes how to solve the shortest path problem of Ebola Virus prorogation using the polymorphic ant colony algorithm, and shows the experimental results in Section 4. Section 5 summarizes our algorithm and suggests our further work.

2. RELATED WORK

2.1 Polymorphic Ant Colony Algorithm

Ants and other insects can achieve complex group behavior like coordination look for food and labor allocation by using pheromones to communicate each other [4]. These biological social behaviors have become an important source of ideas in robots and artificial intelligence. The ant colony algorithm (ACA) was first proposed by the Italian scholars Dorigo et al in nineties in the twentieth century [5]. Dorigo put forward the ant colony algorithm by simulating the seeking-food behavior of ants. Ant colony optimization (ACO) is a technique of problem solving inspired by the behavior of ants in finding paths from the nest to food and a new search metaphor for solving combinatorial optimization problems, and has been unexpectedly successful in recent years [6-10].

It is a heuristic algorithm inspired by the process of ants search for food and it is simulated evolutionary algorithm. The ant colony algorithm first successfully applied to the traveling salesman problem (TSP) [12]. Ant colony algorithm has the characteristics of distributed computing and easy to integrate with other simulated evolutionary algorithm, so it is suitable for solving NP-hard problem expressed by the available graph. The ant colony algorithm and it's various improved algorithms have been widely used and achieve better results to solve vehicle routing problem, fuzzy rule extraction, supply chain management and image recognition and other fields.

Polymorphic ant colony algorithm (PACA) is an improved ant colony algorithm [13] which solved the lack of polymorphism of the basic ant colony algorithm. It divided the ant colony society into three categories: scout ants, search ant and ergate. Scout ant's task is to detect each city as the center for local surveillance, and reconnaissance to detect the result has always been marked to search for scout ants to reach the next station when the city selected to provide supplementary information. Search ant's task is to do global search at every stop and to select the next according to scout pheromone and the pheromones of each export etc, until find and mark the best (shortest) route to the best route from the ergate feeding back to the nest. Ergate's task is feeding back to the nest according to the best route has been marked.

The PACA introduces a different type of ant colony, each ant colony has different regulatory mechanism of pheromone and combine the global search with local search, so the PACA is more in line with the actual information processing mechanism of ant colony and significantly improved the search, convergence speed, effectiveness and efficiency of the algorithm optimization. Simulation experiment results show that to get the same results of the case with the basic ant colony algorithm, the PACA required more less of iterations than the basic ant colony algorithm.

2.2 Description of Shortest Path in Ebola Prorogation

In this paper we consider the problem of shortest path in the uncertain environment. The problem can be described as follows: there are groups of cities allocate to ants to reach, each city only can be allocated to one ant and each ant reach one city at the same time. The goal of shortest path problem is to find the minimization of total cost in different allocation schemes.

For the convenience of modeling, we introduce the symbol:

W : W means the set of cities to be allocated. We denote $W=\{T_1,T_2,\cdots,T_n\}$.

$MAXPC$: $MAXPC$ means maxima1 selectable cities. It determined according to table 1, the data comes from paper [11]. We statistic the optimum solution in different size of cities, C_i means each city in the best solution, make circle use C_i as the center and R as the radius. R increase from zero until reach to the neighbor city of C_i ,then record the number of cities in the circle and denote it as PC_i , $MAXPC$ is the maximum of PC_i .

Table 1 **Statistic results of maxima1 selectable cities**

Number of cities	MAXPC	Number of cities (PC_i =1)
20	8	11
100	9	55
144	13	61
1000	19	545

We can see from table 1 that when the number of cities $n \leqslant 100$, $MAXPC$ <10; when 100< $n \leqslant 1000$, $MAXPC$ <20, and it's probability is above 50%, this means that it have a large probability of selecting the shortest edge which starting from the city C_i . We select neighbor city from the nearest $MAXPC$ cities not from all the remaining cities, by doing this, the solution space can decrease from $n!$ to n^{MAXPC} , making the search speed significantly faster.

c_{ij} : c_{ij} is defined as the total cost of Ant_i complete $city_j$. It contains time resource cost, resource consumption of various materials, communication costs, etc. the time cost is an important factor, so c_{ij} can be computed as

$$c_{ij}=\omega_1 t_{ij}+\omega_2 \lambda_{ij} \tag{1}$$

where t_{ij} is time resource cost, λ_{ij} is other resource cost, ω_1 and ω_2 are weights which satisfy the condition $\omega_1+\omega_2=1$;

x_{ij} : x_{ij} is 0-1 decision variable which defined as follows:

$$x_{ij}=\begin{cases}1, if\ city_i\ done\ by\ Ant_j\\ 0, otherwise\end{cases} \tag{2}$$

$tabu_r$: We define $tabu$ is the taboo table of each ant which memory the cities have already assigned. After each interaction, $tabu$ will be cleared. $tabu_r$ means the $tabu$ of Ant_r .

The goal function is define as

$$\min\left(F(x)\right)=\sum_{k=1}^{n}\sum_{j=1}^{m}\sum_{i=i1}^{in_i}x_{ij}c_{ij} \tag{3}$$

3. SOLVE SHORTEST PATH PROBLEM BASED ON PACA

The PACA-based shortest path problem mainly involves three types of Ant: Task allocation Ant, Task execution Ant and Environment Ant. Task allocation Ant is responsible for the task decomposition and task allocation; Task execution Ant is responsible for accept the task and execute it; Environment Ant is responsible for administrative tasks' and Ants' information, it does not involved in decision-making of task allocation in a distributed environment.

In the use of PACA for shortest path, the Task allocation Ant which assume the role of scout ants in PACA is a key player

in decision-making of shortest path, and the Task execution Ant which assume the role of search ants in PACA is a key implementer in decision-making of shortest path, the Environment Ant does not participate in decision-making, so it assume the role of ergate in PACA.

We make the following assumptions:

(1)The cities to be allocated at the same probabilities;

(2)Every two cities has road, that cities are independent;

(3)Each Ant do the tasks according the rule of First Come First Served (FCFS).The specific method to apply the PACA to shortest path is: to the Task allocation Ant, put *m* Task allocation Ants to *m* positions, every Ant take it's position as the center to scout another *m-1* positions, to constitute scout pheromone combine the scout result and prior knowledge, then take it as $s[i][j]$, and mark it on the link between $city_i$ and $city_j$. $s[i][j]$ $(i, j = 0,1,2,\cdots,m-1; i \neq j)$ is given by:

$$s[i][j] = \begin{cases} \dfrac{\tilde{d}_{ij}}{d_{ij}}, & \text{if } city_j \text{ in } MAXPC \text{ of } city_i \\ 0, & \text{otherwise} \end{cases} \tag{4}$$

where $\tilde{d}_{ij}$ is the shortest time to another *m-1* cities in the center of $city_i$. d_{ij} is the time of Ant from $city_i$ to $city_j$. First, set the initial pheromone value on each path according to the result as follows:

$$\tau_{ij(0)} = \begin{cases} C \cdot s[i][j], & if \quad s[i][j] \neq 0 \\ C \cdot \dfrac{\tilde{d}_{ij}}{\hat{d}_{ij}}, & otherwise \end{cases} \tag{5}$$

where $\hat{d}_{ij}$ is the longest time to another *m-1* cities in the center of $city_i$; C is the initial pheromone value.

Then, the scout pheromone can provide aid to the Search Ant to calculate transition probability p_{ij}^k and pheromone concentration on each path.

To the Task execution Ant, when Ant $k(k = 1,2,\cdots,n)$ finish the current city at time *t*, p_{ij}^k which means the probability of transfer $city_i$ to $city_j$ calculatedas follows:

$$p_{ij}^k = \begin{cases} \dfrac{[\tau_{ij}(t)]^{\alpha}[\xi_{ij}(t)]^{\beta}}{\sum_{s \notin tabu_k}[\tau_{is}(t)]^{\alpha}[\xi_{is}(t)]^{\beta}}, & if \ j \notin tabu_k \\ & and \ s[i][j] \neq 0 \\ 0, & otherwise \end{cases} \tag{6}$$

According to this formula, every time the Task execution Ant accept a city, only to search in a small range combined with scout pheromone and greatly reduce the search size. When all Ants complete a cycle, the pheromone on each path adjusted according to the following formula

$$\tau_{ij}(t+1) = \begin{cases} \rho \cdot \tau_{ij}(t) + (1-\rho) \cdot \Delta\tau_{ij}, if \ s[i][j] \neq 0 \\ \rho \cdot \tau_{ij}(t), \quad otherwise \end{cases} \tag{7}$$

where the $\Delta\tau_{ij}$ is the sum of pheromone value each Ant released at edge (i, j) in this cycle. And $\Delta\tau_{ij} = \sum_{k=1}^{n} \Delta\tau_{ij}^k$. $\Delta\tau_{ij}^k$ is the pheromone value released by Ant k at path (i, j) in this cycle and it given by the following formula

$$\Delta\tau_{ij}^k = \begin{cases} \dfrac{Q \cdot (\tilde{d}_{ij}/d_{ij})}{L_k}, if \ Agent \ k \ travles \ on \\ \qquad edge(i, j) \ and \ s[i][j] \neq 0 \\ 0, \qquad otherwise \end{cases} \tag{8}$$

where Q is intensity of pheromone and affect the convergence speed at some extent; L_k is the sum time used by Ant k in this cycle. Each Task execution Ant only to release suitable pheromone (combine local pheromone: $\tilde{d}_{ij}/d_{ij}$ and global pheromone: L_k) on the path which probably part of the optimal solution according to scout pheromone. According to formula (6), each Task execution Ant only to raise pheromone concentration on the path which probably part of the optimal solution (decide by whether $s[i][j]$ is *0*).

Therefore, the algorithm process can be described as follows:

1) Initialize *Q*, *C* and the maximum evolution generation
2) Put *m* Task allocation Ants on the *m* cities' positions, every Ant take its position as the center to scout other *m-1* positions, and calculate scout pheromone according to formula (4) and put the result into $s[i][j]$;
3) Set the initial pheromone on every path according formula (5);
4) Set evolution algebra initial value to *0*;
5) Select each Task execution Ant's initial position randomly, and put the position into each Task execution Ant's table $tabu_k$;
6) Calculate the position each Task execution Ant will be transferred to and assume it as *j* and the last position is *i* ,put *j* into each Task execution Ant's table $tabu_k$;
7) Calculate the objective function value $L_k(k = 1,2,\cdots,n)$ of each Task execution Ant and record the current best solution;
8) If reach to the defined evolution generation or the solution has no significant improvement in last several generations, then jump to step 11). Otherwise jump to step 9);
9) Modify the pheromone concentration on each path according to formula (7);
10) Set $\Delta\tau_{ij}$ to *0*, and set table $tabu_k$ empty, $N_c \leftarrow N_c + 1$,and then jump to step 5);
11) Output the best solution.

4. EXPERIMENTAL RESULTS

4.1 Performance comparison of PACA with basic ant colony algorithm

In order to examine the performance of the polymorphic ant colony algorithm in this paper, we complete some contrast experiments. First we imitate the topology of the actual network and produce the required data: Number n of the Task allocation Ants and Number m of the Task execution Ants. The shortest path problem is solved by using basic ant colony algorithm and the polymorphic ant colony algorithm respectively. Then the obtained results are compared with the current results. By means of the adjustment, the parameters were set as follows: n=3, m=5, Q=100, C=3, α=1, β=3, ρ=0.3,

MAXPC=10. In experiment, each test iterates 100 times, and takes the average results of 10 experiments. Performance contrast of the experiment results of the two algorithms is shown in Table 2. The optimization result of each item is indicated with hold body.

Table 2 Experimental results

City numbers	Iteration numbers		Times(s)	
	polymorphic ant colony algorithm	*basic ant colony algorithm*	*polymorphic ant colony algorithm*	*basic ant colony algorithm*
60	127.7	189.3	39.37	63.62
95	208.2	287.6	73.78	107.85
150	261.5	396.8	98.03	121.17

As can be seen from the table, in the same situation, the PACA spends much more time than the basic ant colony algorithm. The mainly reason is in PACA, every time when the search ant arrival a city, according to scout pheromone, it only search in a small range, which greatly reduces the search size.

4.2 Comparison of the results with different parameters

In order to examine how the parameters influence the experiment result, we complete the experiment at the case of group 1 has 25 cities, group 2 has 30 cities and group 3 has 40 cities. We use 3 Task allocation Ants and 5 Task execution Ants, takes the average results of 10 experiments. Table 3 shows the influence of the different parameter values upon the experimental results. As can be seen, the iteration number is smallest (209.1), when α=1, β=3, ρ=0.3, *MAXPC*=10.

Table 3.The experimental results with different parameters of PACA

Parameter setup				Iteration numbers
α	β	ρ	*MAXPC*	
1	2	0.3	11	315.8
1	3	0.1	10	209.1
2	1	0.2	9	383.8
2	3	0.3	8	473.5
3	2	0.1	7	598.3
3	1	0.2	6	637.6

5. CONCLUSIONS

In order to control the further spread of the Ebola virus, make the vaccine efficiently and quickly transport to the hardest hit by the disease, reduce constantly the number and scale of the Ebola epidemic, and ultimately control the spread of the virus, in this paper we considered the problem of shortest path to solve Ebola Virus prorogation problem. We introduced PACA to solve this problem, the experiment result shows that the algorithm are suitable for cases where Ants are motivated to act in order to maximize the benefits of the system as a whole. Comparative analysis the experiment results, we can see that the PACA reduce the weakness in search time and prone to stagnation in problem solving.

Using the three models that we proposed, the Governments and the WHO can accurately predict the development trend of the Ebola outbreak, choose the optimal delivery station and distribution plan of the vaccine, efficiently introduce disease control measures and, in turn, control the spread of the Ebola virus in order to achieve the purpose of the eradication of the Ebola virus.

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Comparison of Different Techniques to Minimize the Dispersion

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Abstract: In this paper, different dispersion compensation techniques are used to compensate the positive dispersion. Three schemes Pre-compensation, Post-compensation, Symmetrical-compensation of DCF, Electronic equalizer of dispersion compensation with DCF and on FBG are proposed. The simulated transmission system has been analyzed on the basic of different parameters by using OptiSystem 7.0 simulator. The results of these dispersion compensation methods are compared in terms of different parameters, which are Q-factor, BER, Eye height and threshold value, investigated at the receiver end. Further, it has been observed that the system needs proper matching between EDFA gain and the length of the fiber for the optimum performance.

Keywords: Dispersion compensation, Dispersion compensating fiber (DCF), Electronic Equalizer, Fiber Bragg Grating (FBG), BER, Q-factor, Eye height.

1. INTRODUCTION

The structure of an optical fiber includes the core and cladding in which the optical cover is led by the internal reflection method. Light encounters factors such as weakness, destruction and changes while passing the fiber. In this project we deal with the simulation of the random dispersion compensation in fiber. In optical fibers, the wave length creates a temporal widening in dispersion pulses. As the pulse moves in the fiber, it starts to widen and lose its basic forms. One of the suggestions for compensating the dispersion is the dispersion compensation fibers which were widely used in random dispersion. Chipper Bragg gratings are recently used for random dispersion compensation of the fibers. Fiber optic communication is a method of transmitting information from one place to another by sending pulses of light through optical fiber. The light forms an electromagnetic carrier wave that is modulated to carry information. The potential bandwidth of optical communication systems is the driving force behind the worldwide development and deployment of light wave system [1].

Like other communication systems optical communication system also faces problems like dispersion, attenuation and non-linear effects that lead to deterioration in its performance. Among them dispersion affects the system the most and it is tougher to overcome it as compared to other two problems. Thus, it is important to work out an effective dispersion compensation technique that leads to performance enhancement of the optical system.

In this paper different compensation techniques and the comparison between them have been presented.

2. DISPERSION COMPENSATION TECHNIQUES

The dispersion compensation is the most important feature to remove the spreading of optical or light pulse in optical fiber communication system.

The most frequently used techniques for dispersion compensation are as follows.

Dispersion Compensating Fibers:

The use of dispersion compensation fiber is an efficient way to upgrade installed links of standard single mode fiber. Dispersion compensating fibers have a high negative dispersion -70 to -90ps/nm.km and used to compensate the positive dispersion of transmission fiber.

According to the relative positions of DCF and single mode fiber the three dispersion compensation schemes (pre-DCF, post-DCF and symmetrical/mix-DCF) are proposed. DCF-pre dispersion compensation is achieved by placing the DCF before the standard SMF. Post-DCF scheme achieve dispersion compensation by placing DCF after the standard SMF. Symmetrical/mix-DCF dispersion compensation scheme consists of both pre- and post-DCF dispersion compensation [6].

Electronic Equalizer Technique:

It is a very attractive technique to compensate for dispersion at the electrical part of the receiver to the transmitter. It is a simple technique that doesn't need any changes in optical transmitting or receiving and also doesn't have considerable loss [4]. Any network changes or adding new devices in the network can be done easily because of adaptive capability of electronic compensator. But there are some disadvantages of this system, for example circuits have limitation in speed compare to optical ones. There are various techniques for using an electronic equalizer, such as: Feed Forward Equalizer (FFE), Feed Forward-Decision Feed Back Equalizer (FFE-DFE), Non Linear Feed Forward- Decision Feedback Equalizer (NL-FFE-DFE) and Maximum Likelihood Sequence Estimator (MLSE) [2].

Fiber Bragg Grating:

Optical Fiber Bragg Grating (FBG) has recently found a practical application in compensation of dispersion-broadening. In this, Chirped Fiber Grating (CFG) is preferred. CFG is a small all-fiber passive device with low insertion loss that is compatible with the transmission system and CFG's dispersion can be easily adjusted. CFG should be located in-line for optimum results. This is a preferred technique because of its advantages including small footprint, low insertion loss, dispersion slope compensation and negligible non-linear effects. But the architectures using FBG is complex[3].

3. SIMULATION SETUP AND DESIGN CONSIDERATION

We have taken a binary source and encoded it using a NRZ pulse.The optical source used is a CW Laser. Light is used as the carrier and modulated using the Mach Zehnder modulator. The signal is pre amplified using EDFA optical amplifier as the signal has a wavelength of 1550 nm. No inline amplification is used.

The simulations of three dispersion compensation schemes are shown in Fig. 1.a, 1.b, 1.c. In these schemes Data source produces a pseudo random sequence of bits at data rate of 20 Gbits/sec. The output of the data source is given to modulator driver which produces a NRZ format pulse. The output of the laser source is CW type at frequency 193.1 THz and output power of 5 dBm. The Mach-Zehnder modulator has the excitement ratio of 30 db. The loop control system has one loop. Each span consists of 250 km of SMF and 50 km of DCF in order to fully compensate for the dispersion slope and accumulated dispersion in transmission fiber. The total length of the fiber channel is 300 km. Two EDFAs in front of transmission fiber (SMF) and DCF with gain 25 db, 20 db respectively and 4 db noise figure. At the receiver side the optical signal transformed into electrical signal by a PIN photodiode, which has 1A/W responsivity and 10 nA dark current. Then the electrical signal is filtered by low pass Bessel filter.

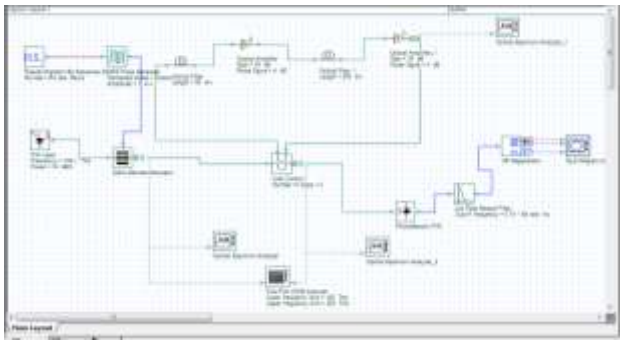

Fig.1.a. Pre compensation of DCF

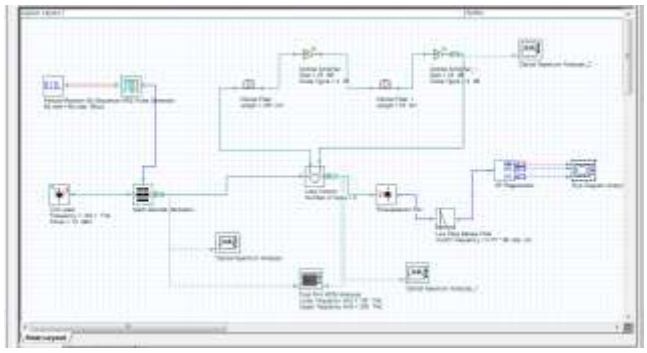

Fig.1.b. Post compensation of DCF

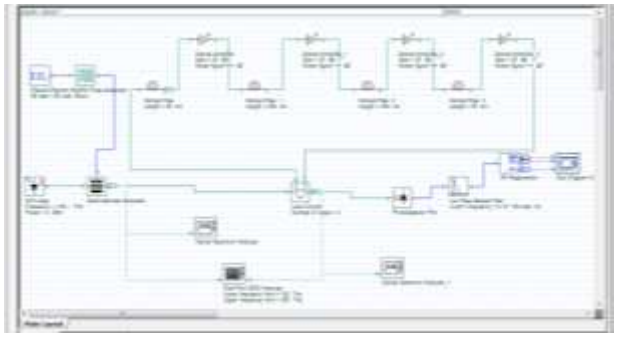

Fig.1.c. Mix compensation of DCF

The next scheme of simulation is to use electronic equalizer [2]. The goal of the simulation is to determine how the number of taps, the resolution of the coefficients, step size and the leakage factor the affect equalizer performance. The motive is to use the outcome of the simulations to establish a feasible hardware implementation. The model used in the simulations is a Optisystem simulation of a fiber optic system with a continuous wave 1550 nm laser, a standard optical fiber of length 50km and a detector in the form of a avalanche diode followed by a low pass filter (to remove high frequency noise) at the receiver[5]. The electronic equalizer scheme is shown in fig. 2.

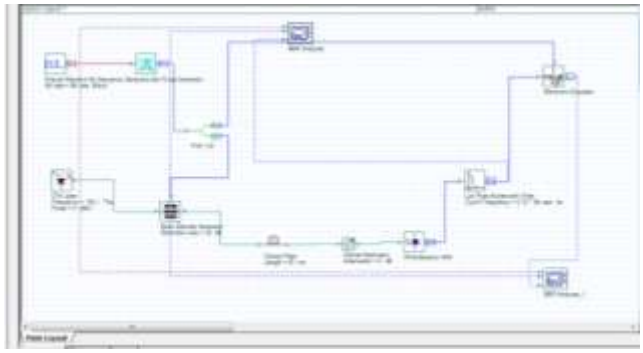

Fig.2 Simulation setup by Electronic Equalizer

The next simulation technique is Fiber Bragg Grating. This is the most important feature of the Bragg gratings which is intensified during the wave length and reflects toward the source and other wave length pass inside without weakening. A chirp in Bragg grating is a kind of chirped that creates changes in the grating period. As the grating period changes along with the axis, different wave lengths are reflected.

Final effect of a compression is in the input pulse which can be accumulated for dispersion compensation in the telecommunication links [3]. Using the fibers of dispersion compensation needs having them inserted in specified intervals with negative dispersion coefficient in a telecommunication link for removing the dispersion effect of the normal fibers. This simulation scheme is shown in fig.3.

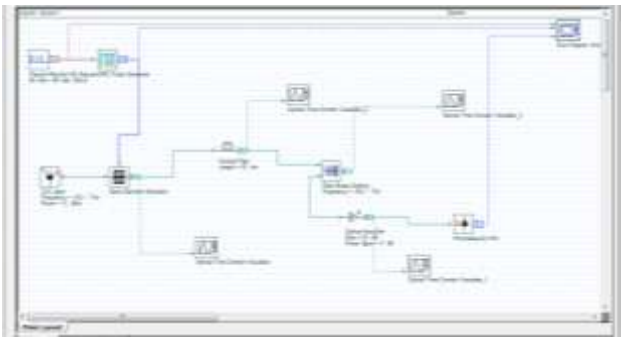

Fig.3 Simulation setup by FBG

4. RESULTS

There are larger no of variable and hence large no of possible variable settings in simulations, it is almost impossible to carry out simulation of each and every possible combination within a specific amount of time. The technique utilized here is to change one parameter at a time, analyze the effects and use these analyses to narrow down the scope of the variables to reasonable amount, keeping hardware considerations in mind. The simulations are performed not for a particular equalizer configuration, rather for different possible solutions with different hardware limitations, results are discussed for a variety of possible implementations. To get an idea of the equalizer capabilities, it may be useful to visualize the performance in the form of eye-diagrams.

The simulations are done in Optisystem 7.0 simulator. The eye diagrams for the three DCF schemes are shown in Fig.4.a, 4.b, 4.c.

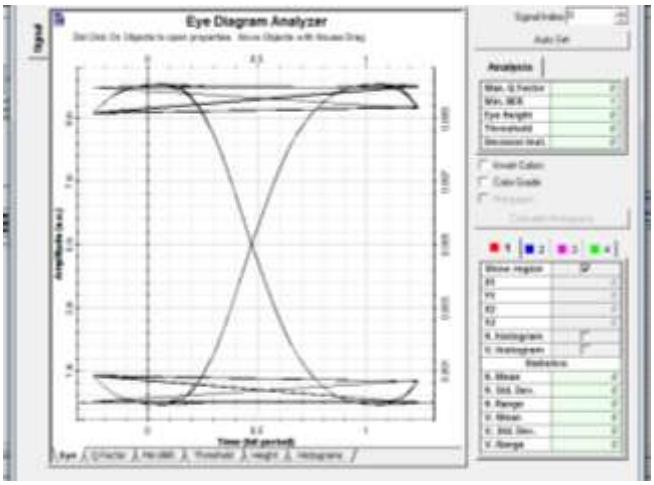

Fig.4.a. Eye diagram of Pre Compensation of DCF

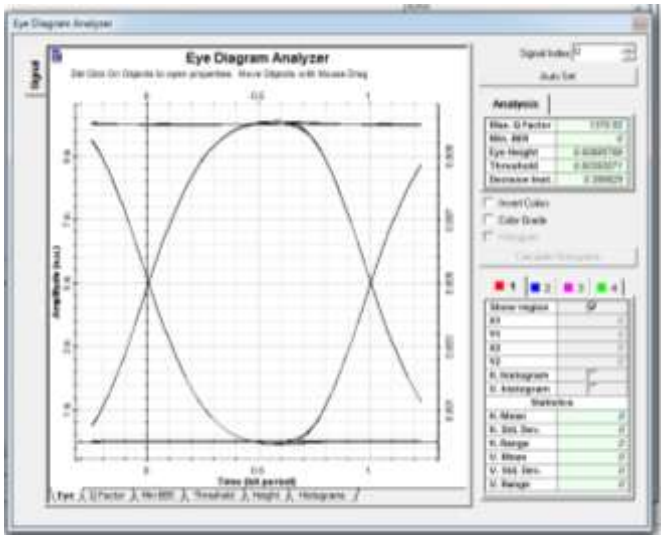

Fig.4.b. Eye diagram of Post Compensation of DCF

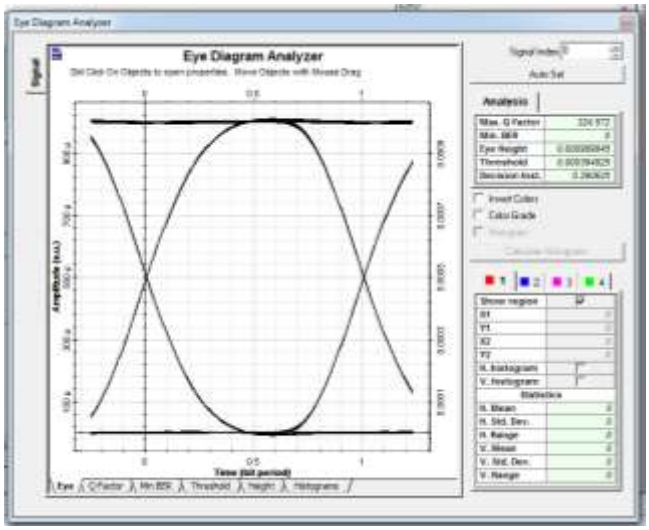

Fig.4.c. Eye diagram of Mix Compensation of DCF

Fig.5 shows the eye diagram of Electronic Equalizer. In this Fig. the BER of the transmitted pulse is obtained with minimum dispersion.

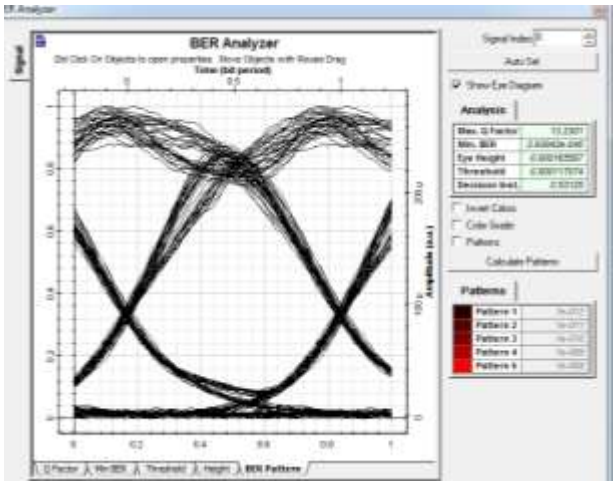

Fig. 5 Eye diagram of Electronic Equalizer

Fig.6 shows the reflection spectrum and eye diagram of FBG for the designed systems. As it is shown in the figure, the pulse is revived and the power reduction can be compensated.

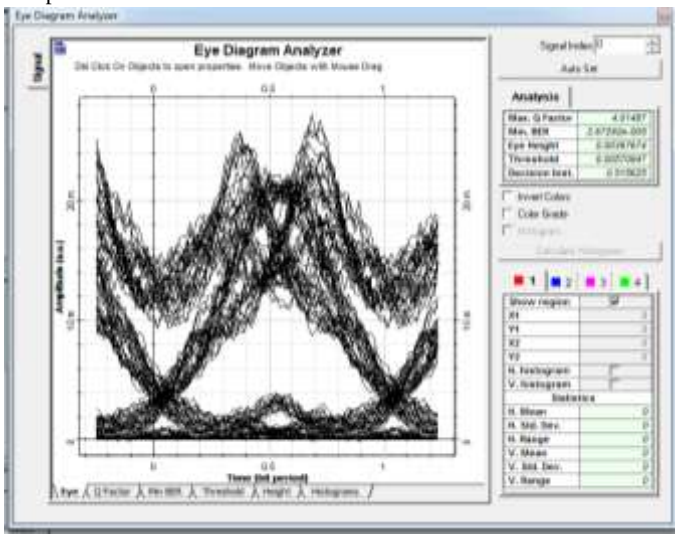

Fig.6 Eye diagram of FBG

The parameters such as, Q-factor, Min. BER, Eye height and Threshold value, for all the three dispersion compensation schemes, electronic equalizer and FBG are tabulated into "Table 1" and compared.

	Q-factor (dB)	Min BER	Eye Height	Threshold Value
Pre Compensation	1084.64	7.79899e-028	0.00090336	0.00026405
Post Compensation	1370.52	1.64538e-023	0.00995789	0.00393071
Mix Compensation	324.572	3.04749e-044	0.000989845	0.000394925
Electronic Equalizer	13.2301	2.93842e-040	0.000165597	0.000117074
FBG	35.2446	1.28591e-272	0.0861831	0.00589062

Table 1: Comparison of dispersion compensation schemes

From the table and from eye diagrams we can see that the mix compensation scheme and electronic equalizer scheme is much better than all the other compensation schemes.

5. CONCLUSION

Dispersion compensation is the optical telecommunication systems is a very challenging and important issue. Without compensating the dispersion, each signal in widened and covers the points near each other so that it cannot be recognized in the receiver.

We have analyzed dispersion compensation with dispersion compensating fibers (DCF) at 20 Gbits/sec for 250 km of SMF and 50 km of DCF. Different schemes of dispersion compensation like pre-, post-, and symmetrical/mix-compensation with DCF, Electronic equalizer and FBG are proposed in this paper. After analysis, we find that the symmetrical/mix-dispersion compensation scheme and Electronic equalizer scheme is better than pre and post-compensation schemes and FBG scheme. To obtain better signal at receiving end, we check for different combinations of SMF length, DCF length and EDFA gain.

This paper analyses the performance of an Electronic Equalizer to compensate dispersion in a 2.5 Gbps optical fiber link. From the above discussions it is concluded that Electronic Equalizer is indeed an effective way to compensate dispersion in a time dispersive optical link. By carefully manipulating various parameters, the distorted signal can be equalized for even higher data rates fiber links.

As it is shown the length of the dispersion compensation fibers is more and so the nonlinear effects appear and make problems. So using these fibers increases the general loss, nonlinear effects and the costs of the optical transmit systems. In addition, the amount of compensation depends on the wave length and can act in a narrow form. The most important advantages of Electronic Equalizer as compared to other suggested cases of internal loss include the nonlinear effects and low costs.

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Map Application Using Augmented Reality Technology for Smart Phones

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Abstract: Global positioning system (GPS) finds nearby doctors like ATM, Bank, Cafe, Bus Stop, Restaurant, Hotel, Movie Theatre, etc. using Location and compass Sensors. The Location Sensor hardware can determine the phone's latitude and longitude as well as place name. This application can use in emergency case; we are able to find location of nearby place and place details. The application allows you to set radius and it also supports Augmented Reality (AR). It automatically finds your current location and plots it on a map.

Keywords: Mobile augmented reality; Location based services; Compass sensor; Global positioning system; Street data.

1. INTRODUCTION

Augmented reality (**AR**) is a live direct or indirect view of a physical, real-world environment whose elements are *augmented* (or supplemented) by computer-generated sensory input such as sound, video, graphics or GPS data.

The AR technology blurs the line between what's real and what's not by simply enhancing the reality around you. It provides a different perspective of the physical world around you with the help of visual media. The term augmented reality simply means enhanced reality. The smart phones help to discover the augmented reality experience in form of visual data imagery, which was normally not visible to you.

With mobile Augmented Reality the computer, or rather , the smart phone is used to extend or improve the quality and quantity of relevant contextual information available at a certain time and place. Most common so far, is a combination of information coming from the smart phones camera.

This paper provides a starting point for anyone interested in using Augmented Reality in Smart devices for location based services.

2. RELATED WORKS

There are various applications that uses augmented Reality. Some of them are:

2.1 A Mobile Augmented Reality Service Model based on Street Data , its and Implementation.[1]

In this the popularity of smart devices and location services is increases day by day and this services are provided by the augmented reality technique. This technology utilizes the embedded Sensors in the mobile device. It helps to user to get more information about a particular location. The app uses the compass and camera view finder sensors to locate places and give the right information on right place.

2.2 Geo-location based Augmented Reality.[2]

The augmented reality is the latest technology which blends and build the computer generated animation and graphics over the physical world. The geo-based augmented reality is the combination of the augmented reality, GPS and location based system these three of technologies build the innovative technology.

2.3 Implementation of Augmented Reality System for Smart Phones Advertisement.[3]

Here this used the marker less augmented reality system on smart phones to design and implement the Smartphone application service. It has an efficiently conveying information on advertisements to users. Here researchers implanted the two-way communication in between the augmented reality and the users through the mark less augmented reality application.

2.4 Mobile Augmented Reality.[4]

It is the branched from the virtual reality in its earlier days the augmented reality used the hardware devices containing a lot of sensors but now a day it can be built in mobile device and because of this the user can access it comfortably and very easily.

2.5 AR Tracking.[5]

This approach of AR tracking can be data based which is the combination of both sensors as well as visions. It pays the attention to the position, movement, speed and the direction of the object. Now-a-days most of the AR implementations in the mobile device use the sensor-based tracking.

3. PROPOSED SYSTEM ARCHITECTURE IN AUGMENTED REALITY USING ANDROID

The proposed system is a location based system and its architecture as shown in figure1 containing various module

1) UI-user interface

2) Google Map Module

3) Find Place Module

4) Augmented Reality Module

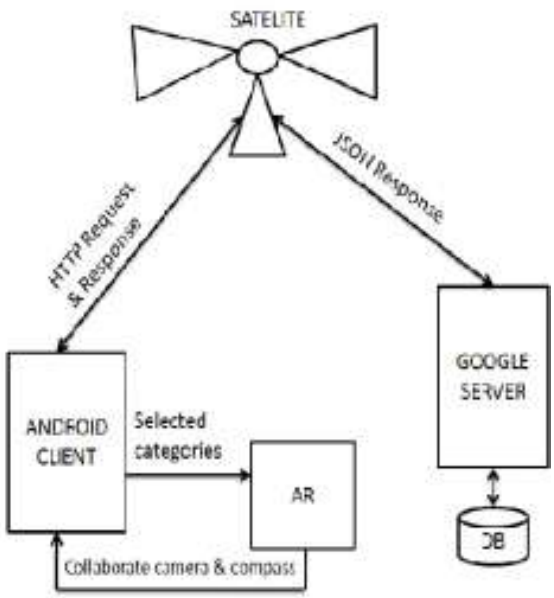

Fig 1. Block Diagram

In this system the client i.e. Android use will select the categories and location and give it to the AR will collaborate with the camera and compass sensor of Android.

For the location finding client will send HTTP request to satellite through GPS system. satellite will then collect the latitude and longitude position of the user then it will send that to the position to the Google server will search near by with radius. it will then fetch the information in the form of name ,id and address of particular latitude and longitude position from the database.

As soon as the result are found the Google server will send JSON response to the satellite then satellite will response to the HTTP request and will give location to the client.

4. Advantages of Augmented Reality

1) AR increase information and knowledge. People can share experiences with each other in real world over long distances.

2) Games that provides an even more "real" experience.

3) Things come to life on people's mobile Form of Escapism.

5. Disadvantage of Augmented Reality

1) Spam and security.

2) UX(User Experience): Using AR can be inappropriate in social situation.

3) Openness : Another people can develop there own layers of content to display.

6. EXAMPLES OF AUGMENTED REALITY

6.1 Tourism

Augmented reality can be used in the field of tourism to enhance user experience during visits. In Bordeaux, for example ,it is possible to view the current monuments in the context of the eighteenth century by simply downloading an application on a tablets.

6.2 Business

There are Multiple uses of augmented reality in a business content .In some physical stores, augmented reality allows users to try on clothes without going to the fitting room.

6.3 Automobiles

In some automobile models, augmented reality technology is used to display information on the windshield. The display

mode provides information regarding speed ,obstacles, the width of the roads and traffics.

6.4 E-Commerce

On a commercial site, augmented reality applies to many areas . some opticians offer consumers the opportunity to try on glasses before deciding on a pair and many decoration and furniture store(such as IKEA) allow customer to visualize object in virtual version of their homes before purchasing.

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Evaluating Socio-Economic and Environmental Impacts of Utilization of Renewable Energy Sources in Iran

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Abstract: Renewable energy sources is a quickly spreading field which has changed significantly over recent years. Besides advancement in technologies of renewable energy sources lead to the production of clean energy in a wide scale. Furthermore, renewables can be an origin of jobs and economically origin of energy. On the other words, nowadays, fossil fuels are the principal energy sources in which electricity is obtained. However, these sources will not last forevermore, and thus in due course renewable energies will have to sub them in this role. All kinds of energy sources have some negative effects on our environment. Fossil fuels — coal, oil, and natural gas — are considerably more detrimental than renewable energy sources by most measures, including pollution of water and air, public health damage, loss of habitat and wildlife, water usage, land utilization, and global warming emissions. Besides regarding social impacts of utilization of renewables is job creation, economics, health, and oil dependence. The goal of this article is to examine and evaluate impacts of utilization of renewable energy sources on socio-economic and environmental status which are able of being renewed if consume properly with the aim of choosing suitable and passable resources of energy as for achieving various policy's intentions and purposes in Iran. On the other hand, this research highlights social, economic and environmental impacts of these resources and after that proposes an appropriate techniques to rank them.

Keywords: Renewable Energy, Iran, Social, Environment, Economics, Energy, Clean Energy, Renewables, global Warming Emissions, land and Water Use, Job Creation, Health, Oil Dependence, Iran

1. INTRODUCTION

Nowadays, all states and governments in all countries are concentrating on topics which are concerning about environments. In association with the point formerly mentioned, all governments are obliged to evaluate the purpose and aim of socio-economic as well as needed and mandatory energies.

Based on international outlook, International Energy Agency (IEA) (2004) declared that energy that is mighty of being renewed is tested by large number of policy-makers in countries that are members of IEA as a tool to chip in develop environmental protection, economic development, energy security recognized as 3 Es. Supposing Ireland as an example. Komor and Bazilian (2005) asserted which many people who drive and stimulate Irish policy about energy that are capable of being renewed can be categorized and settled into energy's purpose, goals retaining to environment and socio-economic / industrial purposes.

Likewise, approximately all of the countries are ensured which those policies that regard energy as able of being renewed must be capable to get each of 3 E goals, and objects (Shen et al, 2010). There are some studies have displayed specific policies' goal that regard energy as able of being renewed takes one to specific sources and technologies as for renewable energy (Beccali et al., 2003; Komor and Bazilian, 2005; Onut et al., 2008).

There are a great amount of complex logical methods to be utilized in order to quest for the most desirable response for multi-purpose obstacles (Greening and Bernow, 2004). One of the most markedly and excellently used methods and procedures is the analytic hierarchy process (AHP) found and established by Saaty (1980). Nevertheless, uncertainty and lack of clarity in many examples is found between the assessments of decision-makers concerning the problems that they look for to deal with. Fuzzy combines with AHP to form fuzzy AHP recognized as FAHP and is employed to examine and weigh the uncertainty and lack of clarity which exists in the valuation of decision-makers subjective.

Industrial and technological improvement resulted in development in living standard and much more energy requesting life. By ongoing rise in energy consumption rates, energy supply will be an actual challenge in a near future for the entire globe and even for the countries which are rich in oil at present. The world energy production rate was 1.65 (ton oE) and 1.82 (ton oE) per capita in 2000 and 2007 respectively, demonstrating growth rate of 10.3 percent (Iran's Ministry of Energy, 2008).

Accordingly, there are a lot of countries that have paid great amounts of money for consideration to use alternative energy resources particularly, the renewables to meet their ever growing energy demands. These countries also have taken actions in improvement and usage of renewable energy technologies to get sustainable development. Moreover, these efforts will also decrease emissions of the greenhouse gases which is one of the current and main environmental problems.

Taking into consideration that the main component of greenhouse gases (GHGs) is carbon dioxide, there is a universal concern regarding diminishing carbon emissions. In this regard, various policies can be applied to decrease carbon emissions, such as boosting renewable energy deployment and cheering technological innovations. Plus, supporting mechanisms, for example, feed-in tariffs, renewable portfolio standards and tax policies, are employed by states to improve the generation of renewable energy along with implementing energy usage performance and efficiency for saving energy (Abolhosseini et al, 2014).

Iran's energy security is based on oil, it means the preliminary source of energy is oil in Iran. In 2000, the production of

energy was 1.84(tons oE) per capita. This amount has been expanded to 2.6(ton oE) in 2007 which demonstrates 41% rise in the rate of energy production. In accordance with the progressive rate, energy production is expected to reach around 4 (ton oE) per capita by 2020 due to socio-economic and ecological improvement, as well as progression of the life standards (Zohoori et al, 2012).

Iran makes a profit from a lot of sources of fossil fuel in the form of natural gas or oil reservoir in the region. The reality is that 18.2% of oil reservoir and 30.5% of natural gas reservoir belongs to Iran. Consumption of energy departments in Iran, use energy in the form of electricity, natural gas or oil, with extremely high subsidized costs for many years. For instance, actual worth for natural gas is 6.60 cents/m3 while in Iran with subsidized prices it decreases to 0.85 cents/m3. Electricity follows the same trend too. For example, Electricity is supplied for use of household users, agricultural and industrial segments with the average subsidized value of 1.65 cents/kWh while according to Iran's ministry of energy 2008, the actual price is 7.36 cents/kWh. Hence, natural gas and electricity are given with approximate 13% and 29% of their genuine prices and this matter is the leading obstacle for expansion and utilization of renewable energy. Besides, there is absence of determination and ambition amongst the users of energy as well as inadequate publicity and rationalization of renewable energy technologies by government circle and media which restricts the application of such green energy resources between all users. Lately, the Iran's government has begun a strategy to delete subsidies for both fuel energy production and electricity, and Iran's parliament has ratified it. Implementation of such strategy will bring about a sharp increase in the energy costs and subsequently will boost production prices too. Thus, inquiry and utilization of renewable energy sources and its relevant technologies in order to avoid prices rise. That's why propagation and promotion of socio-economic growth is an inescapable challenge in near future (Zohoori et al, 2012).

Newly, the major universal challenges of governments are including the diminishing and lessening of climate changes as well as consumption of fossil fuels (Shen et al.2010). Many countries are doing investigations to create and enhance sources of energy which can be retrieved and refreshed in order to get these challenges. Iran, as a country located in Middle East, seeks energies which can be restored and refreshed to meet the challenge of the numerous rate of carbon emissions too (Zohoori et al, 2012).

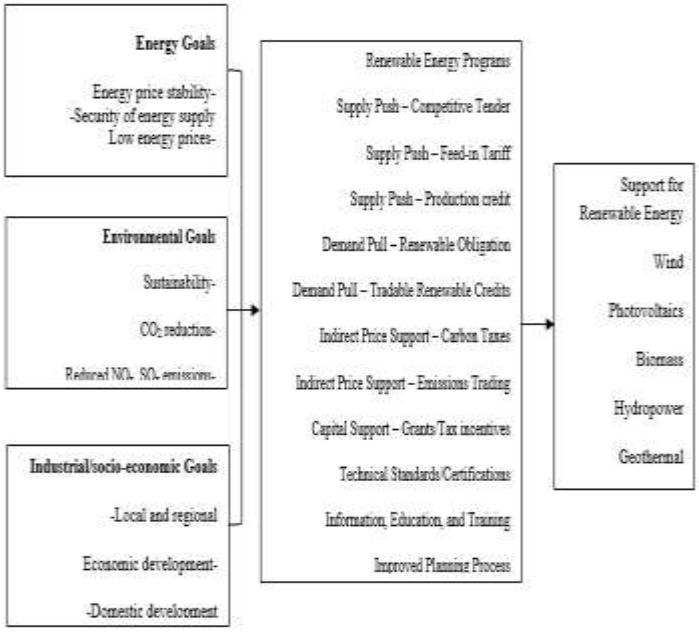
This paper try to highlight major sources of renewable energies in Iran as well as their positive effects on socio-economic and environmental conditions in Iran too. Besides, the research offers a proper technique to rank them.

2. LITERATURE REVIEW

There are too many researches regarding meeting up with 3 Es, and abundant researchers and scholars have emphasized various standards and measures for this. Amongst all scholars, Shen et al. (2010) and Komor& Bazilian (2005) are the most famous and cherished ones.

In the research carried out by Komor & Bazilian (2005), they interpreted the connection and relation between renewable energy programs, 3 Es attempts and purposes and encouragement for techniques of energies that can be restored and refresh as below:

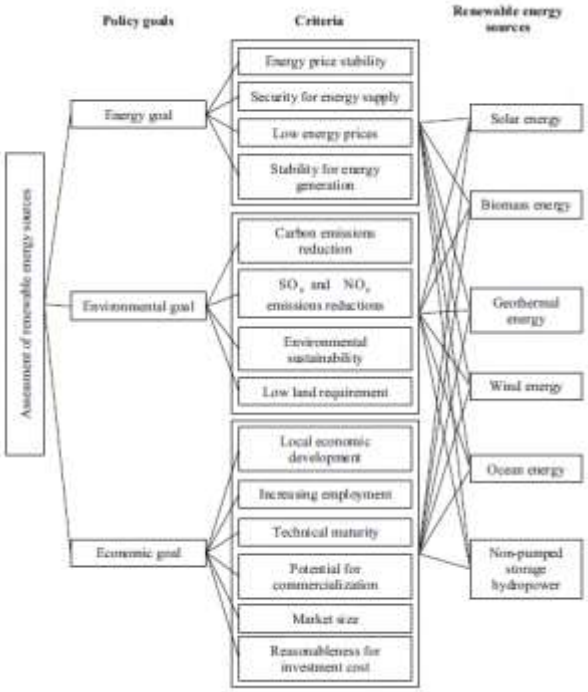
Figure 1: P. Komor, M. Bazilian / Energy Policy 33 (2005) 1873-1881



In another study done by Shen et al (2010), it is considered criteria as follow, and by applying AHP method it is highlighted as a proper renewable energies for Taiwan.

In a different research carried out by Shen et al (2010), it is tested the standards and measures as follow and by applying AHP method it is also emphasized suitable energies which is able to be restored and refreshed for Taiwan.

Figure 2: Shen et al. 2010



2.1 Policy history

The United Nation Framework Convention on Climate Change, With the goal of approaching the challenge of rapid growing worldwide greenhouse gases (GHGs), was constructed in 1992 and rehabilitated by the Kyoto Protocol in 1997 (Bishop,1997). The 2005/32/EC recipe and guidance, particularly the instruction of Eco-design need of Energy-using products (EUP), was legalized by European Union (European Commission, 2005) in response to the Kyoto Protocol. Based on EUP recipe and guidance, the act of importing products will be restricted and limited if the CO2 emissions inside of product be greater than the adjusted standard level (Huang, 2008).

Be based on National Energy Conference held in 2009, R& D or in other words the study and advancement of renewable energy technologies and development in the industry of renewable energy should be dealt with and attended in the policy of renewable energy. Particularly, the progression of the renewable energy industry is now remarked as a strategy to create jobs and national quality of being competitive (Zohoori et al, 2012).

2.2 Renewable energy potentials in Iran

Based on Fadaei et al. (2011) there are five types of renewable energy sources in Iran as below:

2.2.1. Hydropower

As Zohoori 2012, at the moment, water is one of the most fundamental renewable energy resources in Iran, with potential for the production of electricity around 50 TWh. At the end of 2007, based on Iran's ministry of energy, total capacity of functioning hydroelectric power plants was 7422.5MW.

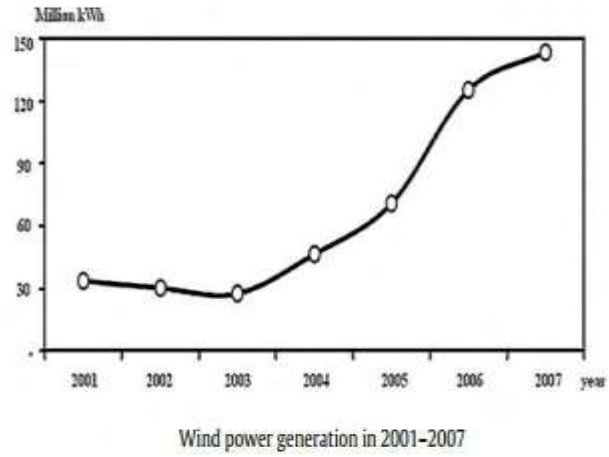
2.2.2. Wind energy

Wind is the second source of renewable energy in generation of electricity in Iran. According to the investigation done by (SUNA, 2009), Iran is a country with 6m/s average wind speed. There are regions in some parts of the country which are more proper for generation of electricity through wind.

Iran is placed in the major air flow path amongst Asia, Europe, Africa, Indian Ocean and the Atlantic Ocean and thus is subject to:

- Pressure center flow over central Asia in winter;
- Pressure center flow over Indian Ocean in summer;

Figure 3: Generation of wind power in 2001-2007 published by energy ministry 2007.



Wind power generation in 2001-2007

-Western flow from Atlantic and the Mediterranean Sea, especially in winter;

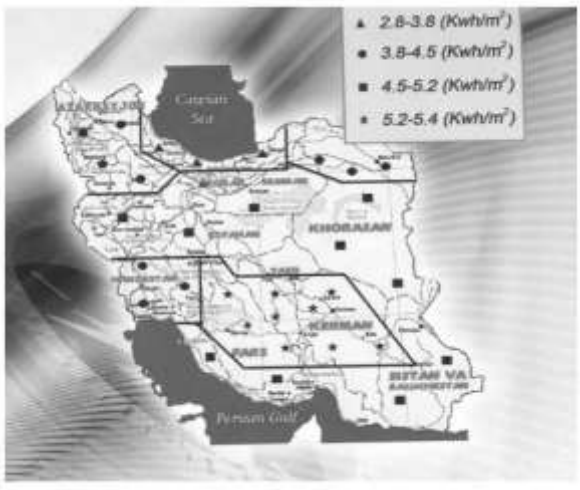
- Northwest flow during summer published by SUNA 2009;

Figure 3 represents which wind power generation was around 140million kWh in 2007, and the government has begun implementing strategy to support private sector in this field.

2.2.3. Solar energy

Iran is placed on world's Sun Belt enjoys around 2800 sunny hours per year. Based on (http: //www.suna.org/.) its solar insulation average is estimated as 2000

kWh/m2 year, As a result of this, Iran has a suitable status for solar energy utilization. Besides, by consumption of just one percent of this source of energy in Iran, It can procure all its required energy (SUNA, 2009). According to statistical reports, total installed valence of photovoltaic electricity generation systems in function in Iran is 175 kW. In 2007, about 71,000 kWh of electricity was produced by Tehran 30 kW photovoltaic power plant and Darbid Yazd and Sarkavir Semnan power plants respectively. (Energy Ministry; 2007). Figure 5 represents solar PV off-grid electricity generation trend between 2001 and 2007. In addition, there are some activities which have been carried out in the field of solar and thermal system application in Iran such as, manufacturing of the prime phase of Shiraz solar thermal power plant with a capacity of 250 kW which is considered as one of the most fundamental plans, but in order to previous projects, this one should be completed until the end of fourth national development plan, however its vapor phase has been implemented until now. Another activity is this field is the installation of nearly 18,000 solar water heaters for household utilization and offices based on (Energy Ministry; 2007). However, no solar heaters was installed in Iran in 2007 (Zohoori et al, 2012).

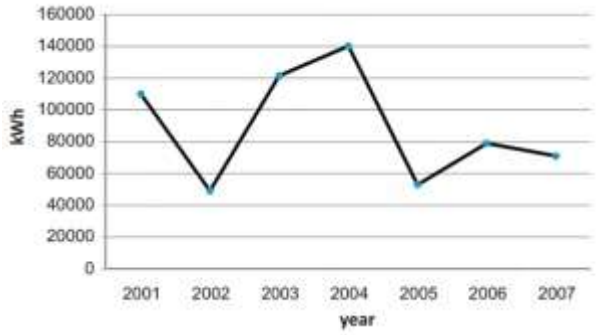


During Iran's third and fourth national development plan, approximately 77,000m^2 of solar collectors were installed (Energy Ministry, 2006). Though, the activities and progressions of other countries such as Germany, Turkey and China in this field, stresses Iran's government that there is a lengthy road ahead of Iran to approach the designed purpose.

2.2.4. Geothermal

At present, there are some programs in Iran which are running in the field of exploitation of this potential.in Iran, Two main activities which are done in this field, are 60% progress of Meshkin-Shahr geothermal plant with a capacity of 370 million kWh each year, and 30% progress of Ardebil 3-5MW plant with a yearly generation capacity of 40 million kWh according to Energy Ministry 2007.

Figure 5: Solar off-grid PV electricity generation in 2001-2007 in Iran (Fadaei et al 2011).



2.2.5. Other renewable energy sources

Iran's Ministry of also has done some activities with respect to other renewable sources including construction and operation of a 25 kW polymeric Fuel Cell as well as designing and manufacturing of a 5 kg polymeric fuel cell with the aim of approaching technical knowledge.(Energy Ministry; 2007)

Furthermore, some feasibility researches has been carried out on biogas generation in Saveh city (600kW power), Mashhad and Shiraz biomass power plants generate 650 kW and 1060 kW respectively. Likewise, it is predicted that the installation operations will soon start based on Energy Ministry; 2007.

Totally, a comprehensive evaluation of Iran's energy supply from renewable sources displays that the overall installed volume of renewable energy sources in Iran has reached more than 110MW up to now (Energy Ministry, 2006). The process of such changes in the installed volume in mid-2007 is explained in table 1.

Installed capacity in renewable energy sources between the years 1997 and 2007

	1997	2000	2003	2007
Solar energy				
Solar photovoltaic	5 KW	47 KW	170 KW	175 KW
Solar water heater	-	-	119 KW	4132KW
Wind energy	1100 KW	10,100 KW	11,800 KW	73,990 KW
Small hydropower	4940 KW	7740 KW	9694 KW	36,050 KW
Total renewable energy resources	6045 KW	17,887 KW	21,783 KW	114,347 KW

2.2.6. Socio-economic impacts of renewables

The manufacturing of any energy power supply system contains the impact at various levels of the society. For example it makes impacts on the technical advancement, to the environment, to the local population as well as to the national economy. It is obvious that some of these impacts are so strict to examine but nonetheless, one should attempt to quantify or to identify the convincible impacts which a certain energy plant will have. Of course these kinds of impacts can be qualified as affirmative impacts under some viewpoints or minus impacts under other viewpoints. On the other hand, an impact can be considered positive or negative due to the opinion of actors. Some actors may not see the impact as such and choose simply to neglect it. For example, normally a renewable energy developer does not assume the impact of such renewable energy plants on the national economy, or how it affects to the various segments of the economy (Gro Waerras et al, 1998).

As Abrishami, et al, (2009) mentioned development of renewable energy has various economic and social interests for Iran. So from where that use of fossil fuels end in near future due to resource constraints in energy supply, this is a very important issue. Therefore, the lack of social and environmental costs are also positive aspects. Besides, the need to save fossil fuels and the use of renewable energy sources is something inevitable due to increasing need for energy and limitations fossil resources, increasing environmental pollution caused by the consumption of these resources, the issue of global warming and the greenhouse effect, acid rain and the need to balance the emission of carbon dioxide. In fact, in some countries the use of renewable energy in electricity generation, have managed to prevent the release of more than 100 million tons of carbon dioxide which is very substantial in reducing environmental pollutants and this is a clear example of the use of technologies of such energies.

On the other hand decentralized production of electricity from renewable energies capabilities has provided development opportunities for remote and rural areas of Iran which this matter strengthens social and economic structure of rural areas as well as prevent their migration to the cities. Furthermore, utilization of renewable energy has been fundamental in terms of employment. Employment status of these systems has been much more than job creation resulting from the use of fossil fuels due to their new nature as the use of these systems is possible for indigenous and local use. According to the conducted surveys installation, implementation, operation and maintenance process from renewable energy realized mainly in rural and deprived areas. Therefore, as regards such areas have higher unemployment rates and the function of these systems can be effective in living population stabilization of these areas. Besides, use of these kinds of energy sources will have a significant role in reducing deprivation as well as growth and productivity in Iran. In addition, effective role in passive defense has significant effects on the provision of appropriate infrastructure in the energy sector and also the country's current energy systems (Abrishami, et al, 2009)

Nowadays, it can be seen by investigation in the energy system features of Iran which lack of diversity in the use of these systems in three areas such as resources, productive technology and distribution network and high uncertainty in the energy system caused that the degree of energy security in the country has been at low

levels thus, it's much more important for Iran which is located in a special area in terms of political, social and economic and military and also is looking for achieving the development goals.

Besides, the development and utilization of renewable energies can play a fundamental role in the increasing of the country's energy system security (Passive Defense). Because use of the infrastructure development of renewable energy sources of the country leads to:

1- The diversity of current energy sources
2- More adjustment with rules and regulations of environmental obstacles
3- Diversity in energy production technology
4- Help to eliminate hot spots Electric power transmission network in oil facilities.

Plus, development of renewable energy function can promote national security, because by examining the prospects for the next 20 years it is observed that a significant part of GDP will be provided through export of fossil energy carriers. However, it is possible to produce energy, to help to maintain continuity of energy exports and protect resources of fossil fuels for future generations with the development of renewable energy (Abrishami, et al, 2009).

2.2.7. Environmental impacts of renewables

It is crucial to find out the environmental impacts associated with the production of power from renewable sources such as hydropower, biomass, solar, geothermal and wind. The precise type and intensity of environmental impacts differs depending on the characteristic of the technology used, the geographic location and a number of various factors.

Different aspects of the impact of renewable energy sources can be analyzed including amongst others: water and air emissions, generations of waste particularly hazardous materials, generation of noise, land use, global warming emissions. Besides, by realizing the ongoing and potential environmental issues associated with each renewable energy sources, it is possible to take steps to avoid or minimize these impacts as they become a greater portion of Iran's electric supply (Ewa Klugmann-Radziemska, et al, 2014).

An entire series of determinants are favoring the advancement of energy sector according to renewable resources: rising social awareness of the need to restrict harmful materials emission, legislation, pro-environmental strategy of governments, by-laws and regulation, support in the form of programs and fiscal mechanisms, not to mention the increasing prices of energy from conventional sources and the need to ensure security of energy (Ewa Klugmann-Radziemska, et al, 2014).

Since the environmental function and performance of renewable energy systems is considerably developed by: increased efficiency and longer lifetime, both should be motivated for the devices and entire systems. In most countries, industrial improvement is conditional on the developer to obtain a legal permission from a regulatory authority which contains evaluating of the impact of the development which may have on the environment. Preservation of the environment is not only a local issue, but also it is an international concern (Ewa Klugmann-Radziemska, et al, 2014).

The concise comparison between environmental advantages and costs of the utilization of various types of RES is demonstrated in the Fig. 6 and Table 2.

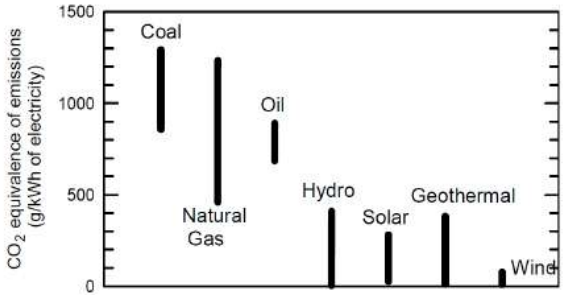


Fig 6: Relevant amounts of greenhouse gases emissions from different types of electricity generation techniques, data are expressed as CO_2 equivalents (Ewa Klugmann-Radziemska, et al, 2014).

Table 2: Analogy between environmental advantages and expenses.

Environmental benefits	Environmental costs
Energy produced by the renewable energy systems Greenhouse gas saving	Production of devices and BOD • Greenhouse gas emissions • Heavy metals emissions • Energy used (Energy pay-back time) Wastes generated by different RES industry

At the present time, Iran has implemented some strategies and policies and incentives to rise the share of renewable energies in order to progress energy security and decrease environmental pollution and build new job opportunities. The strategy and measures can be classified into 3 groups: fiscal supports, knowledge progression, infrastructures, funds, and power purchase agreement tariffs. The volume of constructed and connected renewable energy power plants are displayed in the following table for the end of the year in Iran.

Table 3: Iran Renewable Energy Power capacity – MW (http://www.howtoinvestiniran.com/2305-2/)

Sub Technology	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Large Hydropower	6,533	7,384	7,624	7,656	8,434	8,684	9,746	10,266	10,782	10,782
Onshore Wind	59	74	90	90	93	98	98	98	117	117
Medium Hydropower	36	36	46	47	51	60	60	62	65	65
Concentrated Solar Power			0	17	17	17	17	17	17	17
Small Hydropower	3	3	3	3	3	3	3	3	3	3
Pumped Storage and Mixed Plants										1040
Total	6,631	7,497	7,763	7,812	8,598	8,862	9,924	10,446	10,984	12,024

Iran's total primary energy consumption, share by fuel 2013.

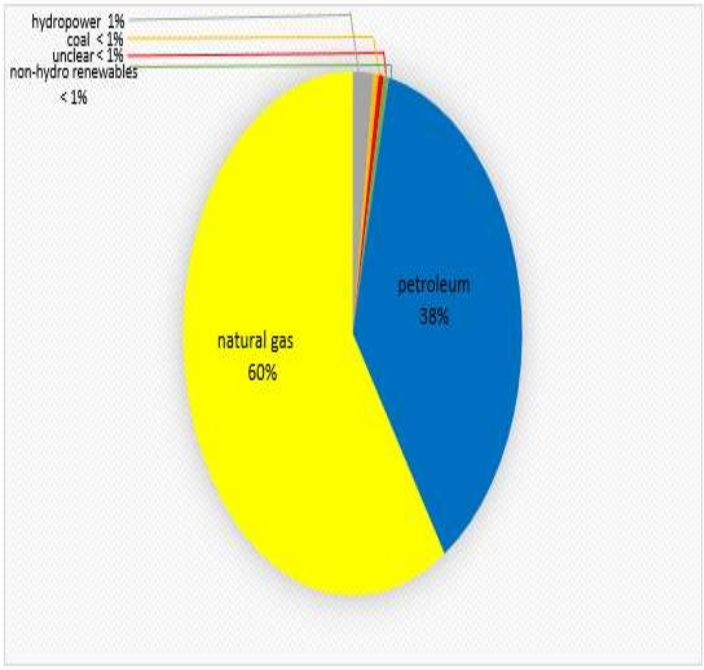


Figure 7: Source: U.S. Energy Information Administration, Frost & Sullivan (2015).

3. PROPOSED METHOD

There are large number of complex logical methods to be utilized in order to study for the most desirable response for multi-purpose difficulties. (Greening and Bernow, 2004). One of the best and most reliable, well-known and great procedures and techniques is the analytic hierarchy process (AHP) found and established by Saaty (1980). However, uncertainty and absence of clarification in many examples is found between the evaluations of decision-makers concerning the problems which seek to deal with. Fuzzy combines with AHP to constitute fuzzy AHP recognized as FAHP and is employed to assess and measure the uncertainty and absence of clarification which exists in the valuation of the decision-makers subjective (Zohoori et al 2012).

The proposed framework of this study is approximately similar to Shen et al framework (2010) (figure 2). However, the renewable sources must be replaced with a 5 sources suggested by Fadaei et al. (2011).

Analytic Hierarchy Process or in other words AHP proposed by Saaty (1980) illustrates and interprets the procedures of deciding the preliminary issue of a set of standards and parameters and the comparative significance of a multi-criteria decision making (MCDM) obstacle amongst them (Saaty, 1980; Wei et

al., 2005; Hu et al., 2009). The major profit of AHP is to conduct multiple standards and measures and doing quantitative along with qualitative data analyses quickly and easily (Meade and Sarkis, 1998; Kahraman et al., 2004). Thus, there are some surveys which have used analytic hierarchy process (AHP) during their planning for renewable energy for example maintainable advancement of rural energy in China (Wang and Feng, 2002), the recruitment of techniques and technologies concerning solar energy in Jordan (Elkarni and Mustafa, 1998), evaluation of renewable energy plants (Chatzimouratidis and Pilavachi 2008.2009) as well as renewable energy planning in South Korea (Lee et al., 2007).

The field of detecting energies which can be renewed and those who are residents of Iran. Furthermore, experts and professionals with high reputation and ranking in the government, or manufacturing line or universities and colleges, are going to be exclusively considered for this study. It has to be mentioned that the size was estimated prior to the Shen et al. (2010)'s survey.

4. CONCLUSION

Nowadays more than ever, the focus of governments of all countries is based on issues concerning environments. In connection with the point formerly mentioned, governments are obliged to test the purpose and intention of socio-economic as well as required and imperative energies. According to global view, International Energy Agency (IEA) (2004) proposed that energy which is able of being renewed is evaluate by large number of policy-makers in countries which are members of IEA as a tools to participate to enhance environmental protection, socio-economic improvement, energy security, recognized as 3 Es. In this regard, there is a high potential for utilizing and exploiting renewable energy sources in Iran too. Be based on Fadaei et al. (2011) there are five sources including Geothermal, Solar, Wind, Hydropower, and others. Thus, it is possible to rank these sources by applying AHP method based on 3Es' goals.

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A Novel IDS Technique to detect DDoS and Sniffers in Smart Grid

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Abstract: Smart grid doesn't have a single standard definition to define it. Commonly, Smart Grid is an incorporation of advanced technologies over the normal electrical grid. Smart grid provides some novel features that mainly includes two way communication and automatic self-healing capability. Like the Internet, the Smart Grid consists of many new technologies and equipment that are bind together. These technologies works with the electrical grid to respond digitally accordingly to our quickly changing electric demand. Even though it is stuffed with pros, it suffers a lot due to its fragile data security. Smart grid usually have a centralized control system called SCADA to monitor and maintain all the data sources. Attackers would always tend to sneak through this centralized system through numerous types of attacks. Since SCADA system has no definite protocol, it can be fixed into any kind of protocol that is required by the utility. In this paper, the proposed method provides two techniques one to detect and remove sniffers from the network. Another one is to safeguard the SCADA system from the DDoS attack. Promiscuous mode detection and MD-5 algorithm is used to find the sniffers and by analysing the TTL values, DDoS attack is been identified and isolated. The proposed technique is also compared with a real time his electronic document is a "live" template. The various components of your paper [title, text, heads, etc.] are already defined on the style sheet, as illustrated by the portions given in this document. Do not use special characters, symbols, or math in your title or abstract. The authors must follow the instructions given in the document for the papers to be published. You can use this document as both an instruction set and as a template into which you can type your own text.

Keywords: *Smart grid; Network Security; Cyber Threats; DDOS; SCADA; Sniffer; Promiscuous mode .*

1. INTRODUCTION

Fundamentally, smart grid is an intelligent grid that connects generation, transmission, distribution and customer end- use technologies with information. It also possess dual way communication. The need to incorporate all the systems that produce and distribute energy with customer usage is one of the very reliable design principles of smart grid. System integration is accomplished using information and communication systems.[1] Smart grid is not forcibly a combination of specific parts. It is a process of using information and communications to integrate all the components that make up each electric system. Rather having a simple electrical infrastructure, smart grid has an intelligent infrastructure. Smart grid has three different perspectives such as regulatory, utility and customer perspective. On utility side, smart grid also gives instantaneous information on system operations, power failures and power outages.

2. SIGNIFICANCE OF SMART GRID

The crucial factor that makes smart grid an ineluctable technology is the two way communication model. This keeps the consumers active and makes them to participate in the grid system.[2] They can choose their tariff with lot of options. Customers would also get a clear idea about their electricity charges and understand about how far their individual behavior in handling the power resources reflects in their billing. The major driving forces such as aging infrastructure, non-reliable intermittent resources and increase in energy demand and sustainability makes the world to move towards the smart grid. National Institute of Standards and Technology (NIST) provides a clear reference of the Smart grid overview in Fig 1. And a comparison of normal and electrical grid is made in Table 1.

3. SCADA SYSTEM

3.1 SCADA

SCADA (Supervisory Control And Data Acquisition) is a centralized control system in smart grid .It gathers information from all metering system and from RTU's. It remotely controls the operations of the smart grid and also gives alarm during emergency. The SCADA system control can either be manual or be automatic.

3.2 Attacks in SCADA system

In SCADA there are so many vulnerabilities due to the complete integrated computerized grid system.[4]**.**Hence there are various types of attacks that march towards the SCADA system. Some of the major types of attacks are Eavesdropping or Replay Attack, SQL injection attacks, Denial of Service Attacks, Identity Spoofing or IP Spoofing, Man in the middle attack, Related Key Attacks and Spyware Threats. [5] Even though there are many considerable ways of countermeasures that have been identified, many unsupervised threats and attacks are raising regularly. In this paper, a novel IDS method to detect DDoS attack and Sniffing attack in SCADA

Table 1. Table captions should be placed above the table

Graphics	Top	In-between	Bottom
Tables	End	Last	First
Figures	Good	Similar	Very well

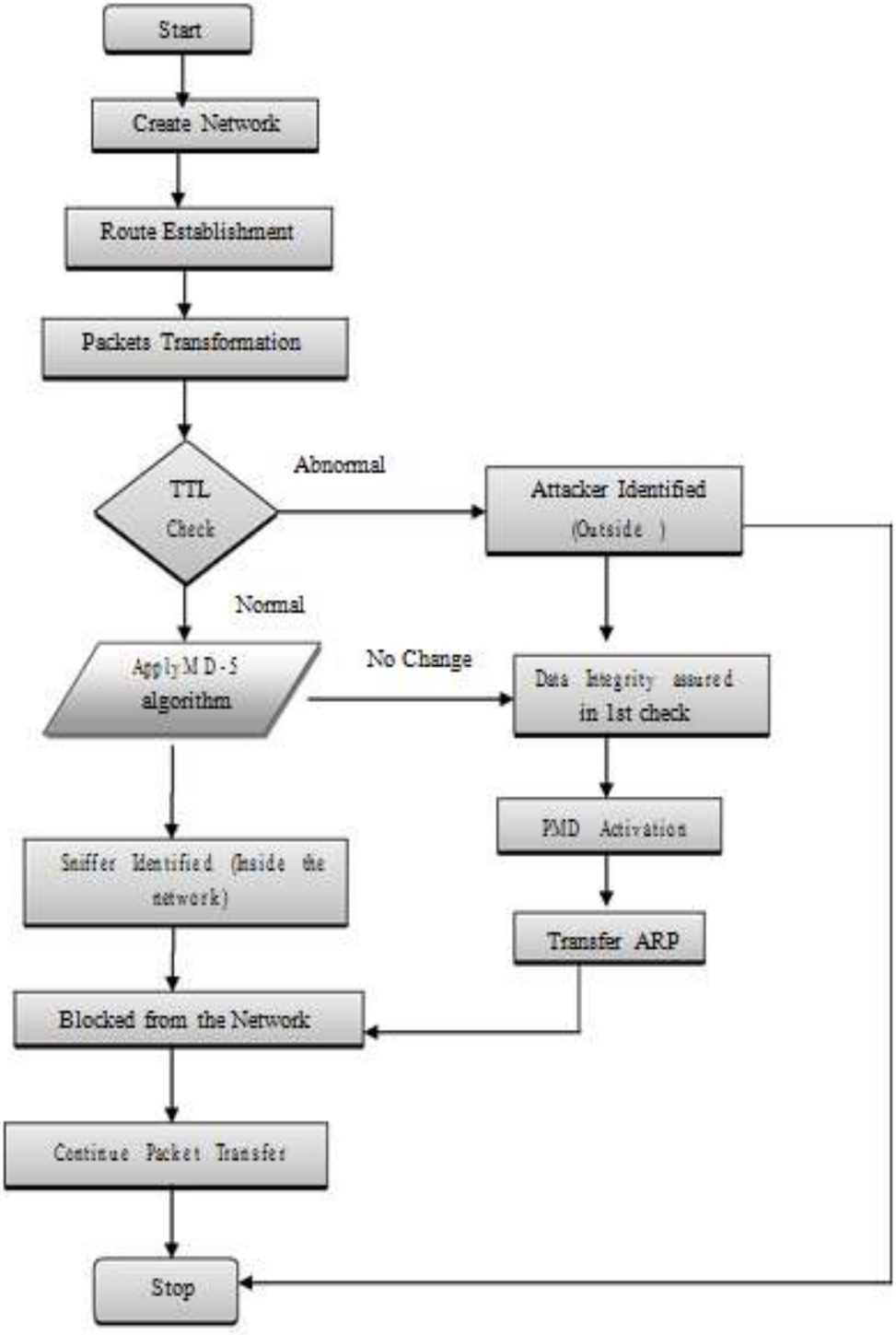

Fig. 1. Flowchart for Proposed Work

3.3 Promiscuous Mode

Promiscuous Mode [6] is a mode for a wireless network controller (WNIC) that passes a controller to pass all traffic it receives to the CPU rather than the frames that the controller is intended to receive. This mode is normally used for packet sniffing This mode is normally used for packet sniffing that takes place on a router or on a computer connected to a hub or being a part of WLAN. It allows a network device. It allows a network device to intercept and read the packets in the entry point itself.

4. DETECTION AND REMOVAL OF SNIFFERS BY DOUBLE LAYER PROTECTION

In this paper, an IDS technique called double layer protection method is proposed for the detection and isolation of sniffers. Initially, we transmit all our data packets through MD-5 encryption technique. A hash value is produced using a hash function in MD-5 mechanism. It is done by using NS-2 tool by implementing the TCL code of MD-5 algorithm. In fig 1.the flowchart explains about the proposed work. It explains the flow of detection of intruders in both inside and outside the network.

4.1 Using MD-5 algorithm in the First layer detection

MD-5 (Message Digest) algorithm is always preferred for preserving the data integrity. Initially, MD -5 fixes the output length of 128 bits in spite of any variable length input message. The original message is padded with one bit and as many zeros are added to bring the message into 64 bits. In the diagram A,B,C,D represents the 32 bit word. This algorithm is used to produce 128 bit hash value.MD-5 algorithm has the following steps :

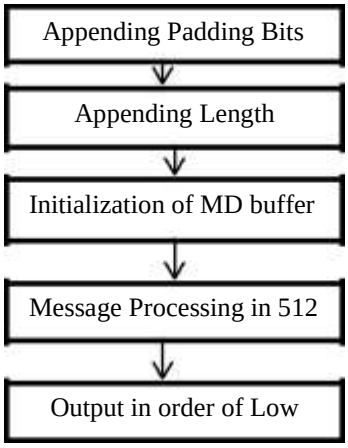

Fig. 2. Steps in MD-5 Algorithm

The MD -5 algorithm uses 512 message block to alter the state of the constants based on a non linear function F. For each block of input, four round operations are performed with 16 operations in each round.

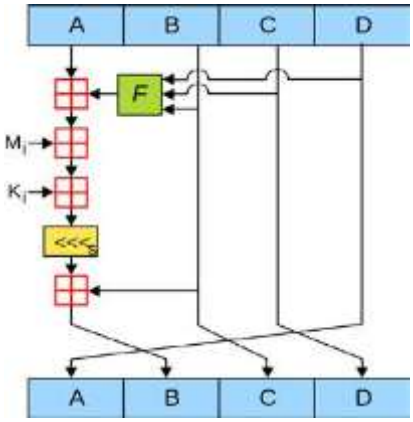

Fig. 3. Sample MD-5 operation

F denotes a Non linear function

M_i denotes a 32-bit block of the message input

K_i denotes a 32-bit constant, different for each operation.

<<< denotes a left bit rotation by s places; s varies for each operation

⊞ denotes addition modulo 2^{32}.

The four possible predefined functions of F in MD-5 is : FF(B,C,D) = BC v not(B) D

FG(B,C,D) = BD v C

not(D) FH(B,C,D) = B xor

C xor D FI(B,C,D) = C xor

(B v not (D))

Main loop in MD-5 algorithm is as follows : For i from 0 to 63

if 0 = i = 15 then

F := (B and C) or ((not B)

and D) g := i else if 16 = i =

31

F := (D and B) or ((not D)

and C) g := (5×i + 1) mod

16

else if 32 = i

= 47 F := B

xor C xor D

g := (3×i + 5)

mod 16 else if

48 = i = 63

F:= C xor (B or

(not D)) g := (7×i)

mod 16 dTemp :=

D

D := C

C := B

B := B + left rotate((A + F + K[i] +

M[g]), s[i]) A :=dTemp

end for

The steps and the sample MD-5 algorithm is shown in Fig. 2 and Fig. 3 respectively. Even though the messages are encrypted with a secured hash key, they can be cracked by using advanced techniques. Intruder may use wireless network hacking tools such as Aircrack, Airsnort and Netstumbler to crack WPA access.Hence until unless the system identifies the source system of the sniffing packets, it is quite tedious to safeguard the integrity of the data. Hence one more layer of security called PMD (Promiscuous Mode Detection) is introduced to find the source of the intruder.

4.2 Detection of sniffer using PMD technique in second layer detection

In this approach, the malicious system is identified by sending fake ARP packets to all sources that send data packets to the supervisory system. Since the ARP packets is present in all IPV4 based system, we prefer to send these packets. The ARP packets will find out the system that has promiscuous mode in activation which is probably a sniffer. [7,8]

In detail, every system has a NIC (Network Interface Card) to receive the incoming packets. All sniffers has an intention to receive all the incoming packets to gain information from the victim system. Hence they would activate promiscuous mode in their NIC. After the activation of PMD mode, NIC would not check the MAC address of the incoming packets and it simply forwards all the packets to the system kernel. We use Address resolution packets to query MAC address from the ip address.[9] System kernel will response to all packets it receive and mistakenly it may also respond to the packets that are not belong to its machine address. By using this mechanism, we can send duplicate ARP packets to all nodes present in our network. If the NIC has not enabled its promiscuous mode, then it rejects[10] the ARP packets that doesn't belong to its machine address. But if it accepts the packet, then it is confirmed that the system is running sniffers. As soon as the malicious system is identified, it must be isolated.

5. Detecting DDoS attack by TTL analysis technique

Before the detection of the sniffers by MD-5 algorithm and PMD activation, we have to analyze and stop the fake incoming packets that are responsible for DDoS attack [11]. The challenge is to find and differentiate the nature of the incoming packet whether it is a genuine request or not. Most of the DDoS attacks happen outside the network.[12] Hence a finite method of identifying the fake incoming packets that comes from outside the network is to be identified. Such a method is TTL analysis technique.ie; Analyzing the TTL(Time To Live) value of the incoming packets and there by differentiating the packets by its normal and abnormal TTL value. Hence the packets that are from outside the network may have crossed more hops than the packets inside the network. Therefore, the malicious packets are detected by its abnormal TTL value and it is rejected. (packets inside the same network has no change in its TTL value) . Table 2.explains the variation of TTL value with respect to OS and its protocol. The comparative values of normal and abnormal TTL is given as :

Normal TTL value: if 30<TTL<= 64 : 98 <TTL<= 128 : 225 <TTL<= 255
Abnormal TTL value: if 1<TTL<= 30 : 64 <TTL<= 98 : 128 <TTL<= 225

Table 1. Different TTL values for different OS and their protocols

OS	Version	Protocol	TTL value
CISCO	-	ICMP	254
LINUX	2.0 x kernel	ICMP	64
LINUX	2.4 x kernel	ICMP	255
LINUX	REDHAT 9	ICMP,TCP	64
SOLARIS	2.5.1,2.6,2.7,2.8	ICMP	255
WINDOWS	2000,XP, VISTA,7,8	ICMP/TCP/ UDP	128
MAC	10.5.6	ICMP/TCP/ UDP	64

As it is discussed earlier, to detect sniffers the supervisory system send ARP packets to all the system present in the network. The tool used for the deployment of this technique is Network simulation-2.As soon as the malicious packet sender is identified, he is excluded from the network. [13,14]. After the detection of sniffers, we also cross check the integrity of the data through encryption technique.ie; Thereby the confidentiality of our data is been preserved. CISCO packet tracer is the tool used to setup packet filtering for the detection of DDoS attack. To preserve privacy, TTL analysis is one of the efficient method but not the only method since equally enriched methods have also been proposed[15]. But particularly in this tool, the packet tracer uses statements such as ACCPET and DENY to create a access list for filtering the packets .Such as simulation setup is shown in fig.7

5.1 Access list for ip packets based on TTL filtering

Here Cisco Packet Tracer is used for the simulation. By pinging the nodes of the network, the TTL value decrementation is tested. There should be some filtering mechanism for TTL values created by the access list in Cisco packet tracer. The following access list contain TOS level 3 to filter IP packets with the exact TTL values of 30 and 40 (variable) and also with the TTL value higher than 160. IP packets with TTL ≠ 1are identified and information about

such packets that doesn't satisfy the filter is immediately passed to the console. Then the console will reject or block those malicious packets.

ip access-list extended

incoming filter denyip any

anytos 3 TTL eq 30 40 denyip

any any TTL gt 154 fragments

permitip any any precedence flash

TTLreqlog interfaceethernet 0

ip access-group incoming filter in

Number of Routers :3

Number of Servers : 2

Number of Clients : 6

Number of Switch : 2

5.2 Filtering Packets Based on TTL Value

Following steps are to be followed to execute our filtering strategy. Add the permit and deny statements until unless, it fulfills our filtering criteria.

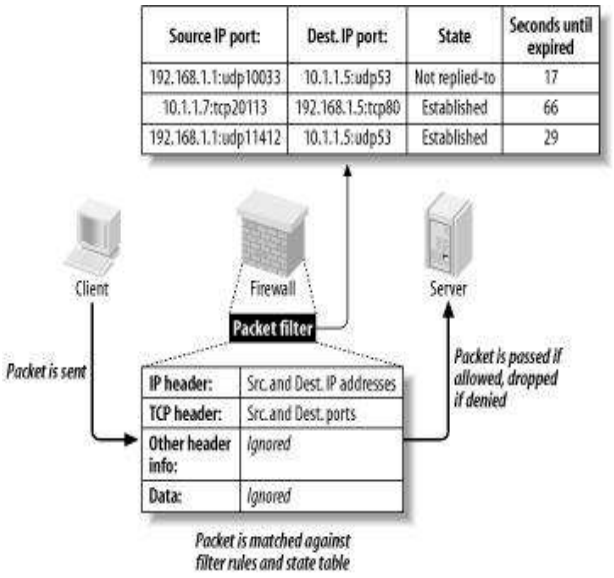

Fig. 4. Structure showing how the packet filter works

2. configure terminal

3. ip access-*List extended* access-Ordering by name basis ip access is being defined

list-name - To filter the desired TTL value the access list has to be extended.

4. [*sequence-number*] permit *protocol source-wildcard destination destination-wildcard* [option *option-name*] [precedence *precedence*] [tos *tos*] [TTL *operator value*] [log] [time-range *time-range-name*] [fragments] - Sets conditions to allow a packet to pass a named IP access list.To clear the IP accessed named list, a set of conditions si to framed for the incoming packets. At least one permit statement is mandatory for an access list.

5. Continue to add permit or deny statements to achieve the filtering you want.

6. exit- Exits any configuration mod

7. interface *type number*- Gets into interface config mode. Prior to that interface type is configured.

8. ip access-group *access-list-name* {in | out}

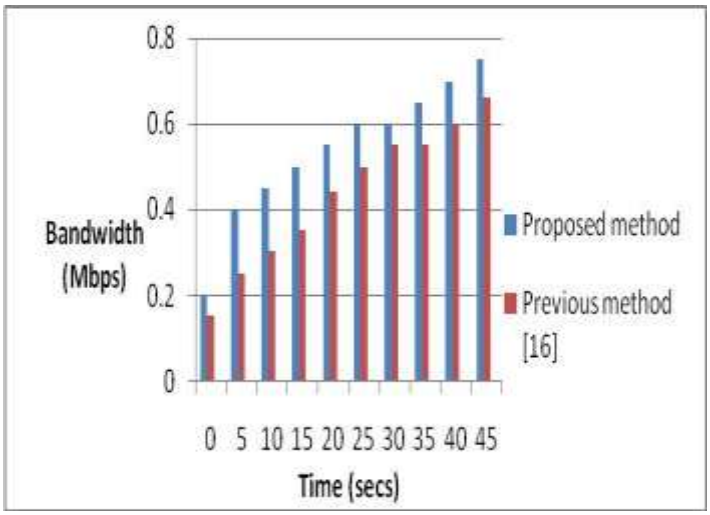

Fig. 5. Comparison of Bandwidth in previous and proposed method

5.3 Summary Steps

1. enable

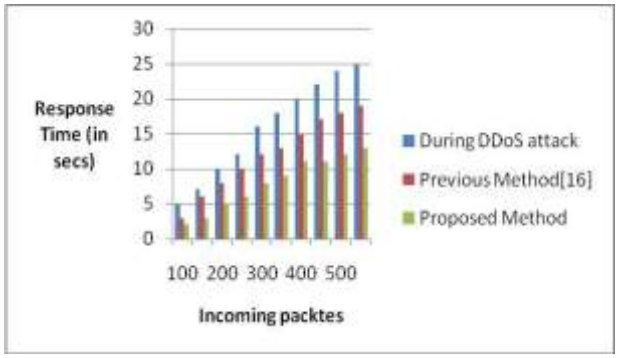

Fig. 6. Comparison of Response time with incoming packets

6. Comparison of proposed technique with Ethereal tool

This proposed technique is also compared with the existing IDS tool to show a better bandwidth. This proposed technique detect sniffers by using very less bandwidth . Unlike the other systems, SCADA systems would be more conscious on the bandwidth they consume. Remote SCADA is polled by a host system in different locations but one at a time i.e. Only one remote station answers at a time. Data traffic is either a poll from the host to the remote or a response to a poll from the remote RTU to the host computer. Therefore either of the communication should not lag even a minute delay because of high bandwidth consumption.

Even though tools like wire shark may show a better performance in throughput than the proposed method, they lag in bandwidth. They consume more bandwidth for the detection of DDoS and Sniffers. In Fig. 7, sample traffic is analyzed and in Fig.8 the bandwidth of ethereal is recorded. Then in Fig. 9, the IDS tool(ethereal) bandwidth is compared with the proposed work bandwidth. TTL analysis and PMD technique combinedly use less bandwidth. The resultant graph clearly shows the efficient use of bandwidth that obviously suits the SCADA security system.

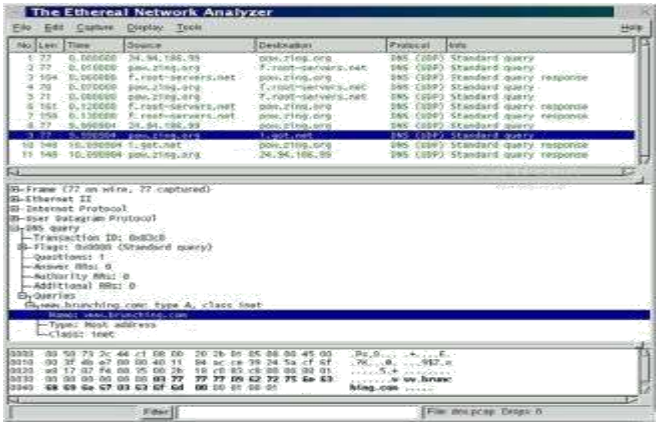

Fig. 7. Traffic analyzer in Ethereal network analyzer

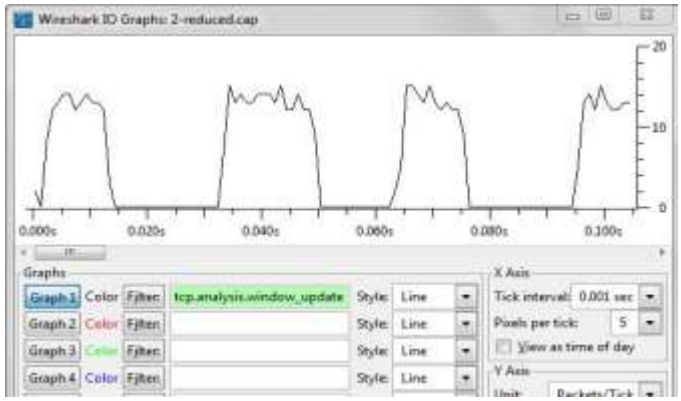

Fig. 8. Bandwidth analyzer of ethereal with traffic by analyzing tcp and udp data.

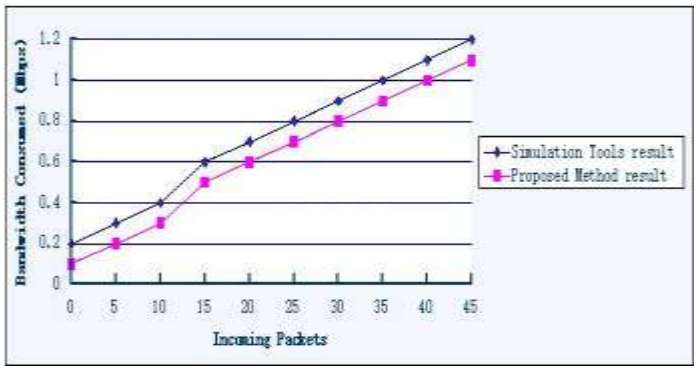

Fig. 9. Bandwidth comparison of proposed method and the IDS tool.

7. Conclusion

Overall, this paper deals with detection and isolation of DDOS attack and packet sniffing. The DDOS attack is identified by fixing the TTL values with certain threshold and there by analyzing the abnormal value packets as malicious. Sniffing is detected by MD-5 and PMD. MD-5 safeguard the data integrity by encryption and decryption technique. PMD helps to find the source of the sniffing packets. NS-2 and network analyzer are the tools used for result comparison.

Important thing to be perceived is that the TTL technique used here is to detect only the attacks from outside the network and PMD is used to detect the sniffers inside the network. It is a tedious process to incorporate two different mechanisms in a single SCADA system, since there is a big time delay. Therefore, a unique hybrid technique would be framed in future so that it must be able to detect attacks in both scenarios with high efficiency.

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