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Particle Swarm Optimization-Intruder Detection for Traffic Prediction over Wireless Sensor Networks

Shashi Shekhar, Neeraj Varshney
Department of Computer Engineering & Applications
GLA, University, Mathura, India-281406
Shashi.shekhar@gla.ac.in , neeraj.varshney@gla.ac.in,

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Abstract
Wireless Sensor Network (WSN) remains a system which is based on a framework with lots of sensor node. The Sensor Node has a reliable data transfer in the sink, which is dependent on aggregate data which are given by sensor nodes. However, due to untrustworthy wireless communication nature and traffic issue, it is difficult to ensure the end to end delay reliable quality as well its timeliness. The proposed work is used to forecast the forthcoming traffic in Wireless Sensor Network. In this work, Particle Swarm Optimization-Intruder Detection (PSOID) is proposed to improve the overall network performance. The abnormal movement is anticipated and it shows the likelihood for violence as well as it starts a hopping occurrence to maintain a strategic distance from this. Increment in the hopping frequency time is distinguished by PSOID model, which give a alert signal to the network which intends will keep away from the anomaly channel. Efficiency of this model is been demonstrated to be productive in recognizing the abnormality station from the imitation outcomes ever since the data about the assailants in the station can be realized utilizing swarm intelligence (particles).Thus the simulation results conclude, proposed PSOID algorithm is enhanced compared to the existing methods in terms of lower energy consumption, advanced amount, lower end to end delay and advanced net lifetime.

Keywords: WSN, energy consumption, network lifetime, Particle Swarm Optimization-Intruder Detection (PSOID), Wireless Sensor Network WSN

1. Introduction

WSN are created by a huge set (hundreds to a few thousands) of homogenous hubs with tremendous sources limitations. Individual sensor nodes are created with a capability of knowledge for signal processing and data networking. These hubs are spread generally over the zone to be observed to assemble information, process it, and exchange it to a focal hub for further preparing [1]. However, wireless sensor networks the hubs are seriously need essential assets, for example, stockpiling, handling force, vitality and henceforth security systems utilized in customary systems are not appropriate for WSN.

There are several challenges are faced in WSN here discussed some of the unique challenges which need much attention to improve network performance. Stringent resources are the most important challenges should be handled by these networks. Due to its small size in nature and network lifetime are considered to be important parameter for issues. One of the main and biggest constraints in WSN is energy. It is the most costly asset [2]. Where a large portion of the sensors are battery fuelled and are used in regions, for example, profound backwoods, seas and so on there for energizing the hubs is a troublesome procedure. Sun oriented fuelled is additionally utilized for change yet batteries are primary asset limitations.
In sensor nodes small amount of storage space will be available; moreover half of this storage will be utilized by resident operating system [3]. Storing of data alone is not the purpose of memory is additionally required for putting away applications, information detected by the gadgets and for chronicle middle of the road after effects of handling. Therefore implementing security primitives in small storage is again a constraint.

In a WSN, every node or hub acts as a router and as a transmitter. The failure in energy sensor can essentially have a change in the network topology and force an expensive redesign as mentioned earlier, most of the communication protocols in AdHoc network don't adjust to the qualities of sensor networks, consequently the need to improvise or to make a development in the new protocols[4].Many routing procedures were made for wireless sensor networks. Some are adjustments of procedures that exist for different sorts of networks (fundamentally for wireless networks in the

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broadest sense), while others were planned explicitly for wireless sensor networks

The aim of this work is to analyze the traffic prediction performance as well as to develop intruder detection algorithm for traffic prediction to ensure improved energy efficient on WSN. The rest of the paper is planned as follows: a brief review of some of the literature works in energy efficiency and network lifetime algorithms over WSN is presented in Section 2. The projected method for PSOID optimization procedure has been shown in detail in Section 3. The exploratory outcomes as well as presentation examination conversation is given in Section 4. At last, the decisions are summarized in Section 5.

2. Related Work

Lee at el real time communication [5] presents challenge in the real time message for WSNs. The Computational power along with narrow bandwidth delivers limitations and has several contrains, which are not appropriate to give real time message. In this manner, the subjects as well as investigation difficulties must deliver to give real time message in WSNs.

Kapalta at el [6] used one such approach called as clustering which has a result by making the lifetime of the network an increase, this procedure is being executed in a periodical manner, Here we divide each round as two phases one is Cluster building phase and the other phase is stable data communication.

Rezaei and Mobininejad [7] recognize two fundamental empowering procedures to be specific: responsibility steering and data driven driven methodologies for making sure the energy is not being missed. Not all the projected methods can guarantee the stable result since the lifetime duration is dependent on the interaction of the antenna nodes batteries.

Benaddy et al [8] presented a multipath routing algorithm for WSN for a reliable quality information broadcast, seeing the remoteness as well as energy ingestion utilization limitations. Numerous uses of Wireless or remote sensor systems are basic, for example, medicinal, disaster organization, ecological, soldierly, transportation, emergency, safety applications. These applications need dependable information groupas well as accomplishment. Investigators have been examined in this area suggesting numerous methods for WSN to encounter out the quality, for example, redundancy or re-transmission mechanisms or multipath routing protocols, a portion of these strategies do not upkeep round the WSN constraint, for example, energy depletion.

Speicher et al [9] offerings the pre-hand-off route discovery(PRD) idea for AODV, which keeps away from these delay as well as empowers mobile nodes to set up a route in the hand-off-target network preceding hand-off. On account of time-differing qualities, the average packet loss rate on remote canal might be low, however its real loss rate is high. Henceforth, it is unmistakably outlandish to utilize the normal packet damage degree as steering metrics.

3. Proposed Methodology

System Model

The prototypical built up in this work is a locked WSN without moving since one sensor network then onto the next network and is thought to be a mono-driven system with one sink. Packet construction is anticipated through counting periodical information and event information all composed. And furthermore, the measure of information being disregarded the system can be resolved not just by seeing point-to-point packet delivery, yet additionally by anticipating the packets by broadcast path. It is accepted that the node can move inside the comprising WSN. The structure wherein congestion happens is the fundamental idea. The episodic and occasion information are accumulated at the sink since traveling and spending in the city are presented. The network is partitioned in N areas altogether. The Sink is situated in the network and the N segments are situated in the peripheral zone. The correspondence radii of every sensor node are the equivalent and every node is answerable for all elements of the approaching and active information. In each area, the episodic information and occasion information are created.

3.2 Sensor Node Traffic Prediction

3.2.1 Packet Generation

In this work, idea of economics of production is used in order to compute the packet generation. Oncewe, evaluate jointinspiration for all variables, the relative change, bounciness is important. Thus, the pliabilityexamination will become as easy while the packets are generated as the ordinary logarithm [10]. Therefore, packet modeling produced in network is done by using CobbDouglas production function indicating the relationship of input and output for knowing the aspects of production. Especially, the Cobb-Douglas production is a useful function in Economics as its been utilized frequently as a utility function, so that it will be essential in order to reproducein the modelling once it has been analysed to know the efficiency of the network in the future.

It expected that if the quantity of sensor movements as well as the control level are expanded h times in network, the quantity of packets will be expanded h times which shows a character of consistent returns to scale. The node situated in i region yields packet Di by utilizing Si by sensor action and Energy Ei.

3.3 Path Traffic Prediction

Throughout the WSN information transmission, the executive procedure for network use is as follows;

- Traffic Generation: Predicts the number of transfers made per hour in or out system.
- Traffic Distribution: Number of transfer prediction among the Source-Sink.
- Data Transmission Protocol: Predicts each Percentage using a transmission technique
- Routing Protocol: Predicts the Path-specific broadcast total.

These abovementioned four elements can have a prediction in sequential order, while we use Step 4 the transportation

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demand analysis model. The estimated result develops the input for the approximation of the subsequentphases. These stages are shown in Fig.1.

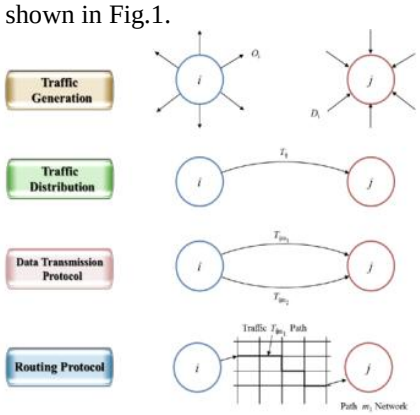

Fig.1 Traffic Demands Analysis 4 Steps

It predicts transportation generation and traffic distribution, and assumed that any data transmission/routing protocol can be used in this network model.

Traffic prediction using PSOID

The expectation traffic stream esteems and the genuine worth are contrasted to check the incorrectness of the two whether they are in the certainty level or not. The hubs exposed to assault when it isn't in the certainty interim. TP speaks to forecast traffic at certain time and TA speaks to genuine traffic. The contrast between two is indicated as

$$F = |T_A - T_P| \quad (1)$$

Let P signifies the threshold value

When $F - \varepsilon_{Tt} > P$ (2)

The present traffic is irregular. So this hub ought to send the Frequency bouncing time solicitation to head hub. Director hub is liable for starting the recurrence jumping strategy.

At the point when a channel of a hub experiences an assault, it quickly begins soaring conference [11]. At the point when overseer hub gets the bouncing solicitation from the assailant hub, it assesses the hazard level, as indicated by the proportion of the quantity of soaring demand hubs to the complete number of the hubs, to decide if recurrence bouncing should begin or not.

In the event that solitary less hubs demand recurrence soaring, recurrence bouncing won't be begun. At the point when the quantity of recurrence bouncing solicitation from the part hub surpasses the edge, manager hubs start recurrence jumping utilizing the correspondence recurrence and recurrence soaring time estimation [12]. The executive hubs gets recurrence bouncing demand from the greater part of the hubs and along these lines begins the recurrence soaring process. It is engaged to distinguish the assaults over the WSN effectively through PSO calculation.

PSO is relying upon the rule that each arrangement is symbolized as a molecule in the swarm. Each molecule has an area in the investigation space, which is recognized by means of a vector xi = (xi1,xi2,...,xiD), where D is the dimensionality of the inquiry space. Atoms move in the quest space to look for the ideal arrangements. Thus, each molecule has a speed, which is signifiedas $vi = (vi1, vi2, \ldots, viD)$. In the development, every molecule refreshes its position and speed as per its own understanding and that of its neighbors. The finest past position of the molecule is documented as the individual best pbest, and the greatest location got by the populace hitherto is called gbest. In light of pbest and gbest, PSO looks for the ideal arrangements by refreshing the speed and the situation of every molecule as per the accompanying conditions:

$$x_{id}^{t+1} = x_{id}^{t1} + v_{id}^{t+1} \quad (3)$$

$$v_{id}^{t+1} = w * v_{id}^{t} + c1 * r1 * (p_{id} - x_{id}^{t}) + c2 * r2 * (p_{gd} - x_{id}^{t}) \quad (4)$$

where speaks to the tth cycle in the developmental strategy. d∈ D means the d[th] measurement in the inquiry space. w is inactivity weight, which is to deal with the power of the former speeds on the present speed. c1 and c2 are increasing speed constants. r1 and r2 are arbitrary qualities consistently dispersed in [0, 1]. pid and pgd indicate the components of pbest and gbest in the dth measurement. The speed is restricted by a predefined most extreme speed, $vmax$,and $v_{id}^{t+1} \in [-vmax, vmax]$.. The calculation breaks when a predefined degree is encountered, which might be a decent wellness esteem or a predefined most extreme number of emphases. The PSO calculation is altered to designate a best nearby manual for each molecule by means of lower precise separation data information. The wellness work figuring is performed dependent on the hubs leftover vitality, data transfer capacity accessibility and postpone time between the hubs [13]. With the assistance of estimated wellness esteem, the position and speed of the hub are refreshed.

$$Fitness(fi) = L_{ec} + H_{pdr} + L_{hc} + M_{dt} \quad (5)$$

Where L_{ec} is lower energy consumption, H_{pdr} is higher packet delivery ratio, M_{dt} is minimum delay time and L_{hc} is lower hop counts

Algorithm 1: PSOID algorithm

Input :Amount of atoms, Acceleration issues c1, c2, Arbitraryamount r1, r2

Output : Best traffic prediction model

Step 1: Start

Step 2: Set the elements (i.e. WSN nodes) with random location and speed

Step 3: For allatom

Step 4: Compute appropriatenesstask using (5)

Step 5: If (fitness value ≥pbest) then

Step 6: Assign presentrate as local best

Step 7: verifty whether the subsequentmessagestation and the presentmessagestation (C) are identical

Step 8: If they are similar, then the supervisor node again directs the info to the subsequentstationthruonward ants in the relatedway.

Step 9: Selectatom with finest fitness value of all atoms as global best

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The occurrencebounding time composed is confirmedas well asoccurrence of assailant for extendedperiod in the canal is recognized by the proprietor node.
Step 10: Update atomlocation and velocity using (3) & (4) and choose best node as CH node
Step 11: Go to step 4 while maximum iteration is attained
Step 12: Every node preserves a true bounding time HTas well as when this time surpasses the onset value η at that juncture it is presumed that the assailant is conquered in the station for lengthier time.
Step 13: At the point when the premise gets this data then it precludes the channel containing an aggressor. At the same time the frontward ants are directedover different stations which are not recognized earlier for assaults.
Step 14 End if
Step 15: End for
Step 16: End

4. Experimental Result

The IEEE 802.15.4 MAC layer is utilized for correspondence amongst the hubs; it gives entrée to the physical station of a wide range of broadcasts and fitting safety components. IEEE 802.15.4 gives 16 stations isolated by 5 MHz [14]. The IEEE 802.15.4 Zigbee underpins Frequency Hopping Spread Spectrum (FHSS) alternatives. It holds a similar essential casing construction for low-obligation cycle, low-control activity and distinctive recurrence groups: low-band (868/915 MHz) and high band (2.4 GHz). The PHY layer utilizes a typical casing construction, covering a 32-piece introduction outline length.

The imitation situations and restrictions are précised in table.

Parameter	values
No. of Nodes	100
Area Size	1100 X 1100 m
Mac	802.11
Transmission Range	250m
Simulation Time	60 sec
Packet Size	80 bytes

Performance Evaluation

5. End-to-end delay

The middling time occupied through a packet to communicate from basis to endpoint thru the system is well-known as point to point postponement.

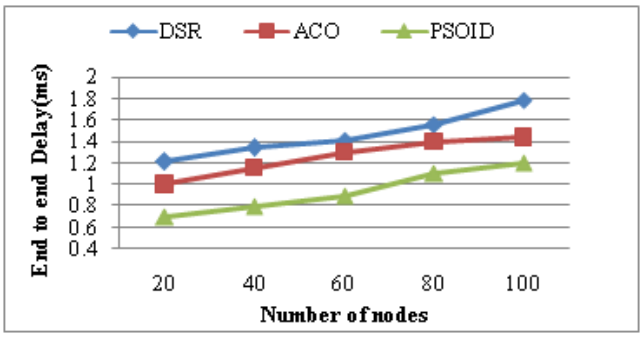

Fig 2 End-to-end delay comparison

Fig 2shows the correlation between the ACO, DSR and PSOID procedures for the start to finish defer execution. The investigation outcome displays that the projected PSOID calculation produces a smaller start to finish postponement than the current ACO, DSR approaches.

6. Throughput:

The degree wherein the information packets are effectively transmitted over the system or correspondence joins is characterized as amount.

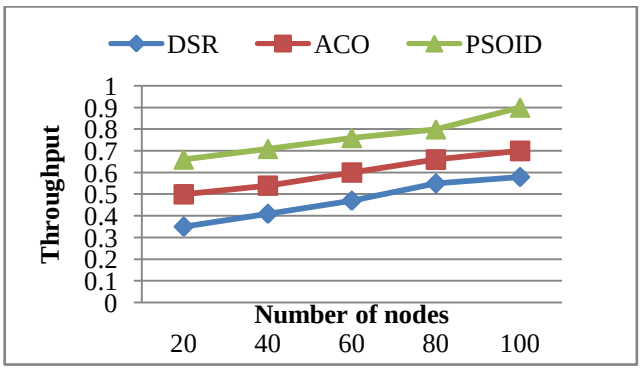

Fig 3 Throughput comparison

Fig 3 delineates the examination between the ACO, DSR and PSOID strategies for the amount metric. It shows that the current ACO, DSR strategies give lower amount though the projected PSOID gives higher quantity.

7. Energy consumption

Energy utilization alludes to the normal energy important for conveying, accepting or sending activities of a packet to a hub in the system during a timeframe

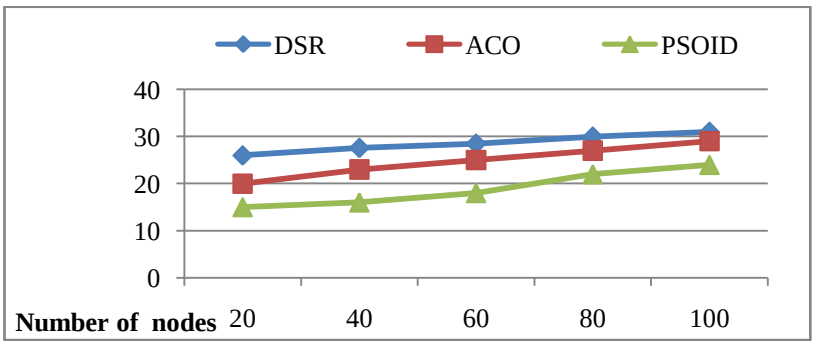

Fig 4 Energy consumption comparison

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From the Fig 4, it very well may be seen that the correlation of energy utilization utilizing existing ACO, DSR and PSOID approaches. It displays that the present strategies give higher energy utilization while the projected PSOID give lower vitality utilization.

8. Network lifetime

The framework is considered better when the projected technique gives higher system lifetime.

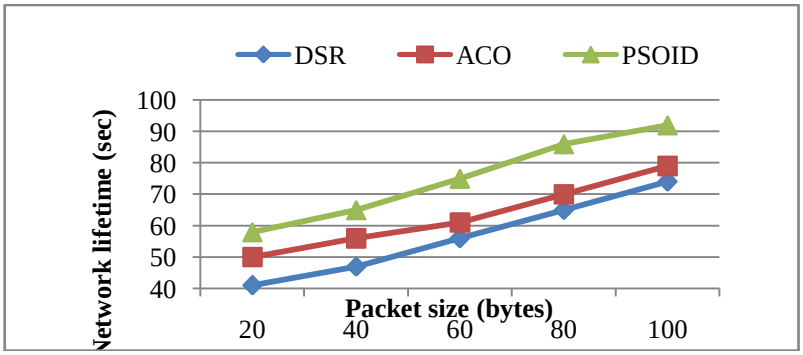

Fig 5 Network lifetime

Fig 5 gives the system era to the given packetextent. The current framework displaysminorsystem execution while the projected framework indicated better. It is additionally seen that the projected framework expands the system era by keeping away from the rehashed utilization of hubs when the packet size increments. It demonstrates that the PSOID calculation gives a more noteworthy system lifetime contrasted with the other existing ACO, DSR approaches.

9. Conclusion

In this effort, planned PSOID calculation is utilized for identifying the traffic design successfully over WSN. It extant traffic forecast model in WSNs, sensor hub pcket age and way traffic through PSOID. Information might not be exact in light of the fact that information utilized in this investigation are not genuine information, assessed information. These issues can be a major effect on the evaluated traffic forecast. At first traffic expectation model identifies the mistake in the system traffic dependent on the real and anticipated traffic esteems. In the event that the thing that matters is over alimit esteem, current traffic is irregular as well as the hub directs recurrence jumping solicitation to the executive hub. At the point when head hub gets the bouncing solicitation from the aggressor hub, it assesses the hazard level and it starts the recurrence jumping dependent on the quantity of hubs mentioning bouncing. Gatecrasher relief calculation with PSO used to distinguish the hubs with flawed channel and alarms the system to maintain a strategic distance from the irregularity channel. The outcome reasons that the proposed calculation gives higher throughput, arrange lifetime, and lower start to finish delay, vitality utilization than the current methodologies.

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