IMPLEMENTATION OF COORDINATION ACTION DETECTION ROUTING POLICY FOR IMPROVE THE THROUGHPUT IN WIRELESS SENSOR NETWORKS

[1]k. Nitya, [2]M.priyanka, [3]S.Krishna kumari, [4]T.Nikhilesh Babu

[1]Assistant professor ,M.tech (ph.d),

Students of Usha Rama College of Engineering and Technology ECE Department Telaprolu234.

ABSTRACT

User equipment coordination in open spectrum systems is a challenging problem, mainly since users experience varying spectrum availability over time and location. We propose a distributed coordination approach that handles spectrum heterogeneity without relying on the existence of a pre-assigned common control channel. Our approach carries the potential to provide robust operation under network dynamics. While this approach can be implemented by upgrading the legacy protocol stack without modifying the addressing protocol, we also describe modifications to the addressing protocol that address spectrum heterogeneity and significantly improve system performance. Experimental results show that the proposed distributed coordination scheme outperforms the existing coordination schemes by 25-35% in throughput and provides a 50% delay reduction.

Keywords: WSN, Throughput, Routing Traffic load, Coordination action Detection.

1. INTRODUCTION

Enormous scope wireless sensor systems have turn out to be a practical solution for observing packages because of past due advances in smaller scale devices, considering hundreds or thousands of little and low-budget sensor hubs to be haphazardly unfold over massive land areas. After their sending, sensor hubs shape a faraway gadget to deliver the detected information to a base station, in any other case called the sink hub. The machine's length is altogether bigger than the correspondence run, therefore, statistics ought to be transferred to the sink in a multi-bounce style. The gadget instance of amassing statistics from the entire machine to the sink is thought the identical variety of to-one sensor arrange. Given the restricted restrict of hubs' batteries, power the executives has gotten a simple issue in far flung sensor structures .Data transmission from hub to hub is the prevailing issue in energy usage and alongside those lines, vitality talent of many-to-one sensor systems is a broadly seemed into issue. As a rule, assembling the detected information to a solitary point (i.E., the sink) is cultivated by using growing a traversing tree whose root is the sink hub . Every hub advances the got information, along the facts created with out absolutely everyone else, to its discern hub, consequently, the essential tree is called sending or guidance tree .Traditionally, tree improvement depends on a least-cost calculation joined with a power aware measurement for the brink value .The subsequent tree comprises of the bottom value methods, in which price of a manner is the complete entire of the rims' cost along that way. This method has the upside of developing simply one tree at some point of a gadget's life expectancy. In any case, the fixed tree methods bring about an plenty higher power usage for hubs that occur to have numerous family, noted likewise because the energy gap trouble .

The directing association proposed right here, in view of a past rendition of this paintings expects to lessen the influences of this issue by way of keeping a strategic distance from to make use of comparable approaches throughout a gadget's life expectancy. At first, a least-fee tree is built and all hubs determine their figure hub in like manner. At everyday time interims (adjusts), hubs rethink the weak spot of the potential approaches and replace their discern hub. Barrenness of a hub relies upon its leftover vitality and the important power for transmitting over the separation among the hub itself and its parent hub. Barrenness of a manner is the maximum extreme hub feebleness along the way. Way feebleness esteems are unfold in a circulated manner by using navigating each edge of the directing tree just a unmarried time. During every round hubs choose their personal base ineptitude manner. That manner information bundles observe a manner of least finest hub weak point alongside the manner, for this reason the proposed association is genuinely a min-max directing method .A big attribute of this technique is that there's no compelling reason to build exclusive bushes (therefore, overhead is kept low). Likewise, the estimations of manner feebleness from the sink hub towards all hubs are proliferated efficiently as it is diagnostically seemed proper now. It is moreover seemed here that there can be no halts underneath the proposed method. Reproduction effects are considered for assessment purposes and the proposed association is checked out in opposition to 8 different sending techniques that display up inside the writing and are portrayed later in Section . Overhead is envisioned as a ways as the amount of extra control messages which might be traded between hubs. To start with, as it's miles everyday exercise inside the applicable writing, overhead underneath all strategies is considered as unimportant e.G., the power devoured for transmitting these additional messages isn't taken into consideration. For this particular case, the proposed arrangement is validated to be near the ones which have the satisfactory execution (as far as first passing time, lifetime, throughput, variety of messages and inertness), notwithstanding the truth that not the exceptional one.

2. LITERATURE REVIEW

The hard assignment of faraway sensor arrange is to extend the lifetime as they're equipped with fundamental battery energy. Once WSN is sent in a debacle territories, blocked off landscapes or infected conditions, battery energize or substitution is incomprehensible. For upgrading the battery intensity of the sensor arrange, special energy powerful directing methodologies are implemented. This paper audits the ongoing power enhancing directing conventions and their exhibition. We first format from fundamental sensor arrange model to steering manner as a ways as vitality development. Our audit closes with the proposals to the future diploma inside the vitality development version for the far flung sensor structures. Current slicing side innovations in microelectronic mechanical frameworks (MEMS) and far flung correspondence advances have grown little measured, ease, low-energy, and multifunctional first rate sensor hubs in a faraway sensor organize (WSN). Remote sensor hubs are despatched and prepared through internet and far off connections, which goes for extraordinary contemporary, logical and army packages, as an example, ecological observing, combat sector reconnaissance, and industry procedure control, medicinal services packages, site visitors manage and domestic robotization. Circulated electromechanical detecting devices (sensor hubs) cooperate to screen bodily or ecological conditions, as an instance, temperature, dampness, motion, sound, radiation, vibration and weight.

Sink Between ness directing (S Bet) [1]

The S Bet is an appropriate measurement for describing the transfer undertaking of a hub. This gift metric's capacity, in preference to the general bloodless-heartedness of the vintage style Between ness, proposes distinct possibilities. S Bet may be applied in a wide assortment of uses, both in the structure and pastime of WSNs. For example, the planner can survey the high-quality sending technique which will make diagrams with an an increasing number of appropriate S Bet dissemination. Such an evaluation have to enhance the comprehension and the board of the system lifetime, for the reason that energy usage seems to be all the greater uniformly disseminated the various hubs. Studies closer to that path require just spatial point system generators (in an effort to reveal the sending fashions), and instruments for diagram investigation; along those lines there is no requirement for either complex discrete event test systems or gadget models. Both are given with the aid of R, a free, multiplatform programming circumstance for measurable figuring and illustrations, which suggests outstanding numerical residences . We additionally believe the accompanying exploration strains: the measurement of the connection between the measurements utilized in this, for example, the bunching coefficient, the regular way period, and the S Bet with the variation to internal failure properties, dormancy and system lifetime, one after the other; the presentation of model to non-important failure plans dependent on the proposed model and metric; the utilization of topology manage plans, in view of the SBet, to lessen the threat of impedance on hubs that were alluringly conveyed around the sensors and the sink, and the utilization of SBet to improve the directing exhibition in WSNs.

Least Transmission - Maximum Residual Energy steerage (LT-MRE) [2]

Lifetime amplification is a massive advancement issue explicit to Wireless Sensor Networks (WSNs) in view that they work with constrained vitality belongings that are in this manner ultimately exhausted. This paper considers first the difficulty of steerage in a WSN with the target of lifetime growth depending on a basic version for battery factors. In precise, we talk about the equality of two precise definitions and preparations inside the modern writing. We at that factor go back to a related difficulty, the correct distribution of a complete vitality sum over all hubs that allows you to augment arrange lifetime. We exhibit this is proportionate to a most short manner problem on a weighted chart and can on this way be proficiently unraveled. At long remaining, we gift an increasingly more affordable version for battery elements, and numerically address the lifetime growth trouble. The observational consequences obtained show that, at the same time as a static directing method isn't always required to be ideal, such an arrangement is a decent estimate of the precise dynamic steerage strategy.

Most excessive Residual Energy Routing [3]

A specially appointed system of faraway static hubs is considered because it emerges in a quick conveyed, sensor primarily based, checking framework. Data is produced in precise hubs and necessities to arrive at a number of assigned portal hubs. Every hub may additionally regulate its capacity internal a specific range that makes a decision the arrangement of plausible one leap away buddies. Traffic sending thru severa bounces is utilized while the deliberate goal isn't inside quick reach. The hubs have restrained starting measures of vitality that is expended in numerous costs depending upon the pressure level and the predicted beneficiary. We propose calculations to select the publications and the comparing electricity stages with the stop purpose that the time until the batteries of the hubs channel out is amplified. The calculations are neighborhood and amiable to dispersed execution. When there may be a solitary pressure degree, the difficulty is diminished to a maximum extreme move difficulty with hub limits and the calculations unite to the right association. When there are distinct force stages then the feasible lifetime is close to the ideal (this is processed with the aid of directly programming) more frequently than not.

3. Existed method

Network congestion is one of the reasons for packet dropping in mobile network. Packet dropping behavior of the mobile nodes are not sufficient to determine the sinkhole characteristics of the mobile nodes. Hence sinkhole detection and isolation methodology based on node collusion is proposed. In node collusion methodology, two or more nodes collude to determine the sinkhole behavior. The node collusion methodology is proposed to reduce the routing overhead, increase the packet delivery ratio and reduce the end-to-end delay of the data traffic. Minimizing the time taken to detect the sinkhole nodes and improving the detection accuracy are also taken into account while designing the sinkhole detection methodology. The proposed method is implemented in DSR and AODV MANETs, experimented and the results are compared with existing state-of-art methodologies. It is found that the proposed node collusion methodology outperforms the existing methodologies.

Sinkhole nodes attempt to lure almost all the data traffic in the network towards is and to affect the performance of the network. The sinkhole nodes broadcast fake RREQ messages large in number in comparison with the normal nodes. The proposed methodology exploits the behavior of the sinkhole nodes in terms of the frequency of the RREQ messages sent out. Once the sinkhole node is setup in the network, it sends out fake route request messages over the network.

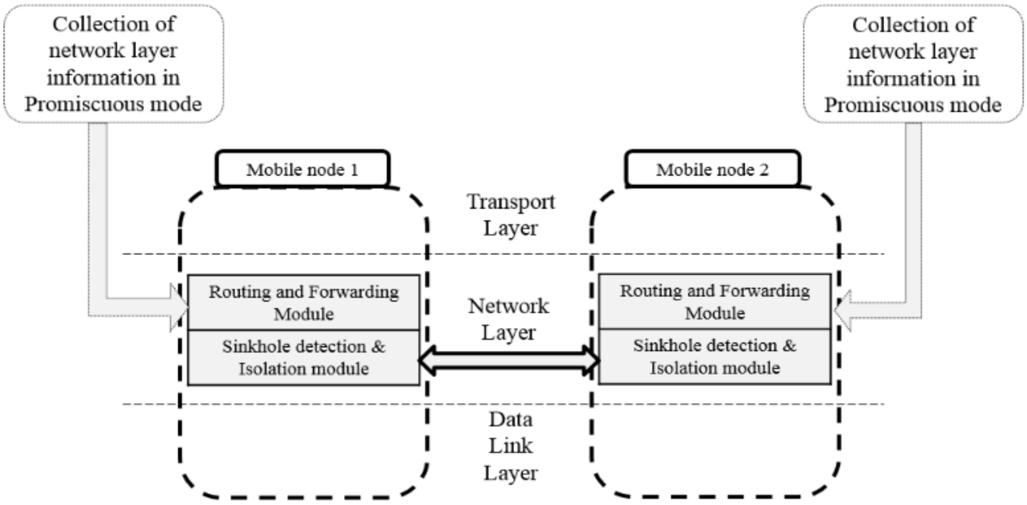

Figure 1: Coordination between 2 nodes in a network

The first delivery of the sensed data (i.e., the delivery at round *r* = 1), takes place over the branches of the initial least-cost tree. At the beginning of any other round *r* > 1, a node *u* has to select as parent node the particular eligible parent *v* that results in the minimum path impotence *M r* (*u*) of the entire path from node *u* to the sink node *s* (for the particular round *r*). In order to make this selection, node *u* should have knowledge of the path impotence for all eligible parents, i.e., *M r* (*v*) has to be known ∀ *v* ∈ *K* (*u*). After a tentative selection of an eligible parent *v* , node *u* calculates its own (tentative) impotence, denoted by the primed variable *m r* (*u*) , from , i.e., *m r* (*u*) = *x* 2 (*u*, *v*) *B r* (*u*) . For this selection of *v* , the path impotence will be the maximum between the already known path impotence of *v* , i.e., *M r* (*v*) and the node impotence *m r* (*u*) (according to the definition of the path impotence in i.e., *M r* (*u*) = max _*m r* (*u*) , *M r* (*v*) The previous steps (i.e., Equations are applied to all eligible parents *v* ∈ *K* (*u*) and eventually, the parent node of the minimum path impotence is selected. illustrates a node *u* and four eligible parents *v* 1 , *v* 2 , *v* 3 , *v* 4 . Suppose that residual energy of *u* is 100 energy units. All four eligible parents have already chose their own parent node, consequently, they already know their path impotence. Node *u* tries one by one the four eligible parents and calculates the resulting path impotence, as follows.

Algorithm 1 Find the Minimum Impotence Path.

Require: *M r* (*v*) , ∀ *v* ∈ *K*(*u*)
u : the node that executes this algorithm
r: the current round
1: **procedure** Find Min Impotence
2: Initialize *M r* (*u*) ← ∞ ;
3: Initialize *p r* (*u*) ← null;
4: **for each** *v* ∈ *K*(*u*) **do** _ Check whether *v* is a better parent node _ Primed variables hold tentative values
5: *m r* (*u*) ← *x* 2 (*u*, *v*) *B r* (*u*) ;
6: *M r* (*u*) ← max _*m r* (*u*) , *M r* (*v*) _;
7: **if** *M r* (*u*) < *M r* (*u*) **then** _ A smaller impotence has been found
8: *M r* (*u*) ← *M r* (*u*) ;
9: *p r* (*u*) ← *v* ;
10: **end if**
11: **end for**
12: **end procedure**

Minimum path impotence formula : $mr(u) = \frac{x^2(u,v)}{Br(u)}$

Above all explanation is related to the proposed method and in this neccasary improvements are needed, so we are moving to coordination action detection routing policy.

4. Proposed Method

The detection of coordination actions is performed. We first provide the correlation map between metrics. Then, we provide the CAD scheme that includes two sub-schemes.

A. Correlation Map

We develop a correlation map, which is a map representing the pairwise correlations of the metrics. Each metric of the map can be called a vertex and a relation/connection between any two metrics is called an edge. We assume that the network works in a periodic manner, where each period consists of a set of discrete time periods. The map is constructed and maintained periodically for each node in the system. At each discrete time period t, a node si measures its working status, i.e., the status for its metrics. Let m be the total number of metrics and vx, t are the value of the x th metric at time t, 1 ≤ x ≤ m. It then has a status vector Si,t = (u1,t, u2,t, ..., um,t). Each edge of the map has a weight that implies the reputation score between the corresponding metrics. The correlation between metrics are estimated in each time slot τ * t, which survives from time (τ − 1) * w + 1 to time τ * w, that is [(τ − 1) * w + 1, τ * w]. Here, w is the size of slot τ . Suppose that Vx,k and Vy,k are the values of metrics x and y collected in time window τ , respectively. We can have the following metrics for the values:

Vx,k = (ux,(k−1)*w+1, ux,(k−1)*w+2, . . . , ux,(k−1)*w+w)

Vy,k = (uy,(k−1)*w+1, uy,(k−1)*w+2, . . . , uy,(k−1)*w+w)

We express the reputation score between Vx,k and Vy,k using the Pearson's product-moment coefficient:

$$C_T = \frac{w \sum_{i=1}^{w} V_{x,k} V_{y,k} - \sum_{i=1}^{w} V_{x,k} \sum_{i=1}^{w} V_{y,k}}{\sigma_{x,k}\sigma_{y,k}}$$

where σx,k and σy,k are their standard covariance. This reputation score is in the range of [-1,1]. If the value is close to either -1 or 1, it implies that there is a strong correlation between the variables. If the value is close to zero, the reputation decreases. As a result, we can build a matrix by putting the reputation score between metric x and metric y as the element cτ (x, y) of the matrix:

$$matrix = \begin{pmatrix} C_T(1,1) & C_T(1,2) & C_T(1,m) \\ C_T(2,1) & C_T(2,2) & C_T(2,m) \\ C_T(m,1) & C_T(m,2) & C_T(m,m) \end{pmatrix}$$

This correlation matrix exhibits symmetry, i.e., cτ (x, y) = cτ (y, x). Furthermore, since any such metric is absolutely correlated with itself, cτ (x, x) = 1. This matrix is a representation of the correlation map.

B. Temporal and Spatial Coordination Detection Schemes

CAD includes two sub-detection schemes, i.e. CAD detects coordination information in the temporal and spatial dimensions in a distributed manner. In the temporal scheme, temporal identification is made such that it refers to abrupt changes in the correlation map of a node. For example, at a given point in time, some nodes may pass some information to an adversary, and then it keeps working normally at some periods. At different time, the adversary may get information for different nodes of the system. In this case, the correlation may change slightly and the change can be overseen by some security protocols. Additionally, a node is shown to work properly and communicates with neighbours, and its authentication to other nodes looks fine. At a point in time, the node may pass information further. Spatial detection determines pattern discrepancies using multiple nodes. If a coordination is detected by both temporal and spatial detection schemes, then the adversary has a high possibility of demonstrating a real problem. The temporal detection scheme investigates the progress of correlation maps over time. In every slot (e.g., [1, . . . , w], [w + 1, . . . , 2w]), a correlation map of node si is computed. If the system operates normally (i.e., no nodes are coordinated or no events such as network congestion occur), the correlation map of the node should remain relatively stable. On the other hand, abrupt changes in consecutive maps imply coordination action. We think that a map may be affected by false positive detection, which is due to factors like heavy network traffics. However, an abrupt change in consecutive maps can be not the sign of traffic.

1) Temporal Coordination Detection: For two consecutive correlation maps denoted by CMi,τ and CMi,τ+1 of the same node (for successive time slots), a sudden change in the map may happen at one or more edges. For example, suppose that two metrics Radio Transmit On and Transmit Counter are highly correlated in CMi,τ , but not in CMi,τ+1. Then, even if all of the other edges are the same, the change in correlation map is considered abrupt. As a result, we concentrate on the timely detection of such changes in individual edges between vertices. In the simulation evaluation, we use a data set that maintains m = 16 metrics per sensor; for each correlation map sequence CM(i), there are a total of m * (m − 1)/2 = 120 different time series. When a time slot finishes, CAD computes if there is a sudden change for any edge. If there is a change, CAD indicates the change as a change point of node si. The detection of a sudden change for each edge in the map is modeled as a change point analysis problem. We propose Algorithm 1 for change point detection by following a classical CUSUM algorithm [20] to detect change points for the time series of a sensor. {c1(x, y), c2(x, y), . . . , ci(x, y)} denotes the reputation scores of edge (x, y) from the first time slot to the current one. In line 3 to line 4, the cumulative totals can be from CT0 to CTn. The insight behind the cumulative totals is that, if there are no sudden changes in the scores, then the cumulative totals just becomes near zero. Suppose that, at the initialization, all the scores are above the average: the term CTCP is always larger than zero, causing cumulative sums CTi to increase gradually. If ck+1(x, y) is an abrupt change, CTk+1 should be much smaller than CSk, k is the last index before the abrupt change. As a result, CSk will dominate both the preceding and the subsequent cumulative sums. The change score is denoted as CTcng. In line 7, bootstrap analysis is provided as a way to verify the significance of the change by coping with the behavior of CUSUM if there are no change points. In this step, the time series ci(u, v) are collected randomly. Based on the random ordered time series, a new sequence of cumulative totals, CTcng, are calculated. After performing bootstraps B times, among which there are D times (CTconf cng > CTth), the confidence level CTconf cng of the new change point, CTcng, is calculated as D/B. When the confidence level of CTcngf is higher than a predefined threshold CTth (e.g., 92%), we say that a sudden change happens in the current time series. As a result, ck+1(x, y) can be achieved as the change point. At the end of the algorithm,

Algorithm 2: Change Point Detection

1. for ith node si
2. Calculate ci(x, y)
3. Calculate CTcng
4. CTi = 0
5. CTi = CTi−1 + CTCP
6. CTCP = ci(x, y) −n_i=1 ci(x, y)/n
7. CTcng = max(CTi) − min(CTi)
8. Calculate CTconf cng ← D* B
9. If CTconf cng > CTth
10. there is a sudden change //possibly due to the coordination
11. Get CTk = max|CTi|
12. // k is the last index before a change
13. Return ck+1(x, y) as the change point.

The nodes whose correlation maps change acutely are detected. As shown in Fig. 1, a reputation scores between nodes in a neighbourhood can be seen.

2) Spatial Coordination Detection: This subsection briefly discusses the spatial coordination detection, taking ideas of correlation maps of all nodes in each time slot, and grouping similar ones together. A node from a subset of nodes whose correlation maps deviate from the common patterns are considered suspicious, as shown in Fig. 1. Node 4's reputation score differs significantly from its neighbouring nodes. The neighbouring nodes can easily report about node 4's reputation, that is, it might be coordinated. Consider that CM1,t,CM1,t, . . . , CMn,t are the correlation maps in a discrete period t of a subset of n nodes; we divide them into K clusters with cluster centroids C1, C2, . . . , CK. The confidence level of node I being suspicious is defined as: min j (dist(CMi,t, Cj)), where dist(CMi,t, Cj) is the fractional distance function between two correlation maps. Based on the distance and node reputation, a node status can be given whether there is a coordination in the node or not. For reducing the false-positive status, the reputation score is considered with the distance. K-Means clustering algorithm is popular for grouping similar kind of values that are used to find the distance based on the correlation map. A node with the farthest distance from the centre can be calculated. We can compute this if a node is coordinated in a distributed manner, where each node makes a status decision based on the distance and reputation score. If the local status denoted by λc of node sj is greater than 0.5, node si can report that node sj 's status is coordinated. Similarly, if a false-positive status is made by node si, it can be detected by other nodes' status decisions. The procedure of spatial coordination detection, based on the above discussion, is given in Algorithm 2.

The coordination detection procedures in both Algorithm 1 and Algorithm 2 are executed in a distributed manner. If we consider a centralized detection scheme, the base station (BS) would handle the coordination detection as well as the application tasks. In each discrete period, the BS needs to make a decision about the coordinated nodes' status that is solely based on the reliable packet transmission of all packets by all nodes in the system.

Algorithm 3: Spatial Coordination Detection

Input: Correlation values of all the neighbouring nodes in time t

Output: A ranked list of nodes sorted by nodes' status and reputation score Status: ($\lambda c \leq 0.5$: normal), ($\lambda c > 0.5$: coordinated)

1. for each ith node si ≤ n where n = |N|,N * S do:
2. // n ← the number of neighbouring nodes
3. (λc)si←− 0 // each node si is normal
4. Get correlation maps CM1,t,CM2,t, . . . , CMn,t
5. Calculate cluster centers as C1, C2, . . . CK
6. Calculate node si's status by (λc)si ← min si (dist(CMi,t, Cj))
7. Find node sj 's reputation score cτ (x, y)
8. if (λc)sj > 0.5 and (cτ (x, y))sj > 0.3 then
9. si marks/reports that sj is coordinated
10. if si does not transmit the decision then
11. sj marks/reports about si as a coordinated

Return a ranked list of nodes with the status resource-constrained system, which usually includes energy and bandwidth constraints. For example, if each node needs to send all its packets to the BS (where each sequence of transmission can have many packets), the centralized BS relies on the on all the packet receptions; it may not be able to reliably offer a coordination detection in a given period.

5. RESULTS

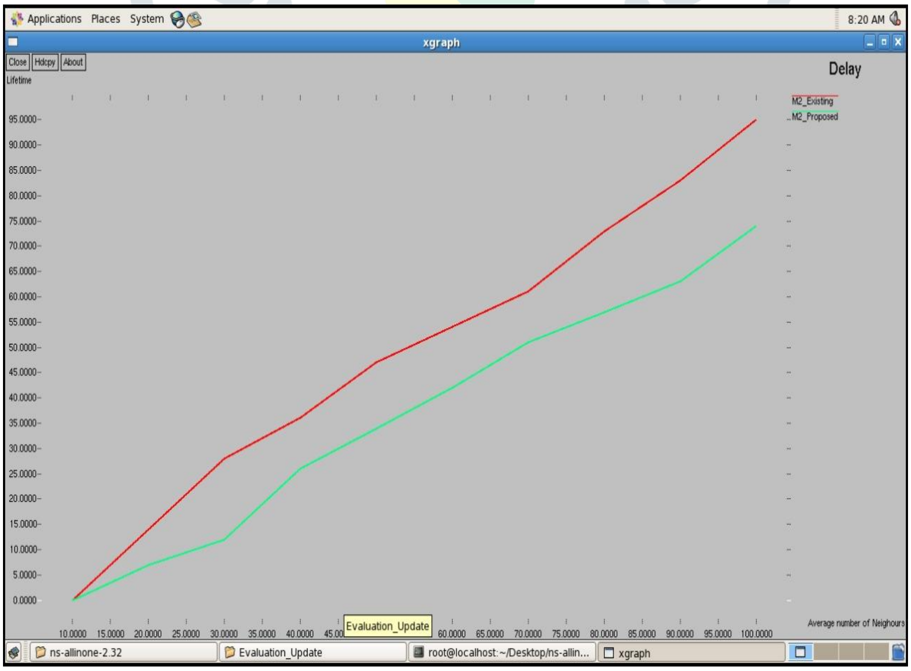

Figure 2: Delay versus average number analysis

Figure .2 explains about delay versus average number of user's analysis, in this Spatial Coordination Detection can archives less delay rate compared to existed method. a ranked list of nodes with the status resource-constrained system, which usually includes energy and bandwidth constraints. For example, if each node needs to send all its packets to the BS (where each sequence of transmission can have many packets), the centralized BS relies on the on all the packet receptions; it may not be able to reliably offer a coordination detection in a given period.

In the above graph we observe that comparison between existing and extension routing policies. In the above graph mainly it is based on to reduce the delay in this extension scheme by using coordination detection scheme. The delay of a network specifies how long it takes for a bit of data to travel across the network from one communication endpoint to another. It is typically measured in multiples or fractions of seconds. Delay may differ slightly, depending on the location of the specific pair of communicating endpoints

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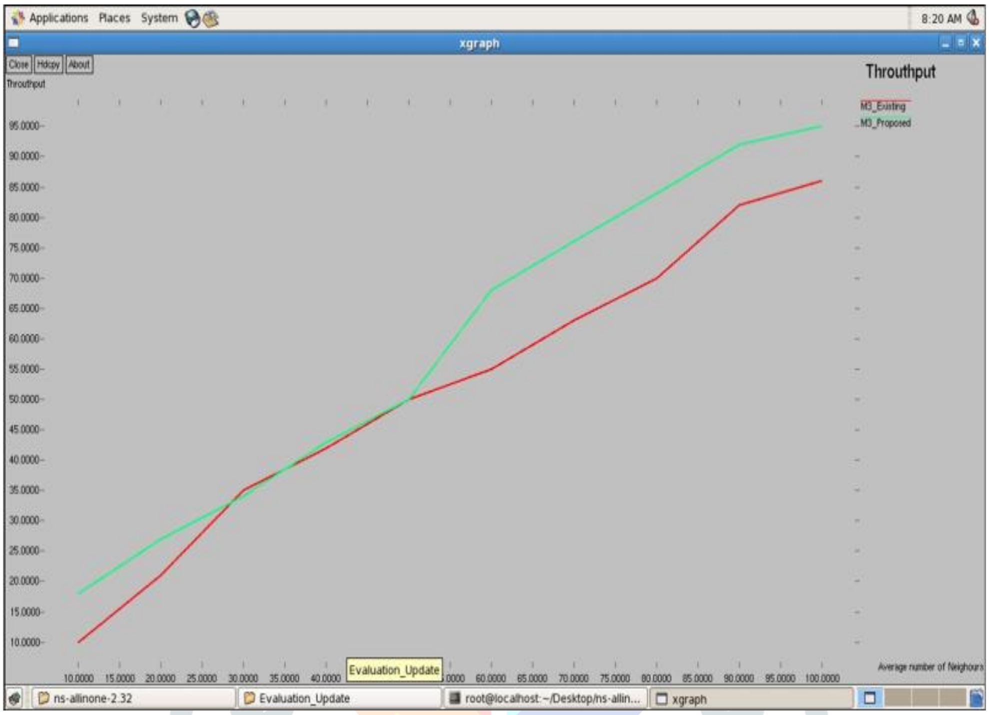

Figure 3: comparison for Throughput of existing and proposing techniques

Above figure: 3 explains about Throughput vs number of users comparison, in this proposed method achives more through put and this is good improvement compared to existed methods. The above figure shown that through put versus average number of numbers .the main goal here is to reduce the delay and increase through put. The above graph is shown that comparison between minimum path impotence forwarding policy and coordination action detection. Here we observe that by using co ordination detection scheme we reduce delay and increase through put.

Network throughput is usually represented as an average and measured in bits per second (bps), or in some cases as data packets per second. Throughput is an essential indicator of the performance and quality of a network connection. A high ratio of unsuccessful message delivery will ultimately lead to lower throughput and degraded performance.

Optimizing Throughput

The throughput on a network can be improved once the cause of low/reduced throughput has been identified as listed under the “Factors that affect Throughput” section above:

- Bandwidth can be increased to provide more throughput especially in cases where the network is overloaded i.e. the bandwidth cannot support the load on the network.
- Bottlenecks should be identified and removed from the network. This will go a long way in reducing latency and packet loss/errors, and thereby reducing congestion on the network. Note that bottlenecks can be as a result of medium limitation e.g. using 100 Mbps interfaces instead of 10 Gbps interfaces.
- Faulty devices/components should be replaced and overburdened devices should be upgraded.
- Quality of Service (QoS) can be applied to ensure that critical traffic is unaffected by network congestion. While this will not improve overall throughput on the network, it will ensure good throughput for critical traffic.

Finally by using extension scheme I.e., Coordination action detection scheme we reduce delay in the above figures and increase throughput by using coordination detection scheme

6.CONCLUSION

We present a distributed coordination scheme to explore under-utilized spectrum in open spectrum ad hoc networks while addressing spectrum heterogeneity. Users dynamically select the coordination channel based on local conditions, eliminating the need of a common coordination channel. The proposed approach can be implemented using existing device stacks with legacy ADDRESSING protocols or using a new ADDRESSING protocol to explicitly address challenges from spectrum heterogeneity. Experimental results show that our approach significantly outperforms existing coordination schemes.

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