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OPTIMAL RELAY NODE PLACEMENT ALGORITHM FOR ENERGY BALANCING IN GREEN CELLULAR NETWORK

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Abstract— The wireless cellular network has seen dramatic growth in some mobile users; the base-station power consumption has increased drastically. The renewable energy is in a base station (BS), because of the traffic load and renewable energy are not well harmonized. So that, energy harvesting of all nearby working base station done by load shifting and strength giving out. The performance of those methods is limited, because of shifting can do by cell edge users only. The energy exchange leads to additional energy gone. Moreover, unbalanced load distribution leads to heavy fill. To reduce the load of BSs, the relay node considered as BSs and also places the relay node in a cell by using liveliness Efficient and Optimal Relay Node residency (EEORNP) algorithm. The relay node is selected by the source BSs which nearby to the destination BSs using Energy-Efficient circulated Relay Selection algorithm. The workloads of a target base station are handled using the multi-size sliding window workload estimation practice.

Keywords: Energy Efficient and Optimal Relay Node Placement (EEORNP), Energy-Efficient Distributed Relay Selection algorithm

I. INTRODUCTION

The explosive increase in mobile message devices and ubiquitous wireless services has incurred significant energy consumption and carbon way. It has been likely that 2% to 10% of global energy consumption and on the subject of 2% of worldwide CO2 emission is caused by the information and letter technology (ICT) industry; wherein base stations (BSs) contribute to 60% to 80% of the total energy expenditure. Moreover, this state will be further aggravated with the evolution of 5G mobile communications, as the forecast shows that the sum of data handled by wireless networks will have bigger by well over a factor of 100 in just a decade from 2010 to 2020. Underneath the pressures from both ecology and nation, lime speech has thereby become an inevitable trend for the future wireless compound.

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1) Energy Saving Techniques

To furnish for the vision of green communications, various energy-saving techniques, such as resource allocation, BS switching, cell zoom, etc., have been proposed in cellular networks. In adding up to reducing the vigor consumption on the demand sides, powering communication systems with renewable vigor on the supply sides is another practical approach to reducing grid energy cost. As an ecological and economic friendly practice, energy harvesting, which can scavenge cheap and clean renewable energy from the ambient situation, has attracted extensive thought and inspired systematic do research in both academia and commerce.

For instance, Hawaii has calculated solar energy mechanical cellular BSs in Bangladesh. Ericsson and Nokia Siemens network also have urban green BSs with energy supplied by solar panels and wind turbines to avoid using any grid electricity. Resulting in its intermittence and randomness consequently, the renewable vigor is highly dependent on the weather and location, cellular networks equipped with energy harvesting devices. However, the offline energy management schemes can be devised to employ the rarely to be ha d renewable energy optimally. Unlike reliable grid, energy provides by power plants, and thus dedicated energy management schemes ought to be designed for them. The conventional energy-saving techniques can be hardly applied to the green if the

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renewable energy profile is deterministic or known to the lead of time.

2) Optimal Relay Node Placement

In this model a wireless network as a set of sensor nodes (SNs) and base stations (BSs) located in a game of known position SS and CP, respectively (e.g., obtained using global or relative positioning devices and techniques). SNs cause data packets and also forward packets received from other nodes towards one of the BSs. Presume that the data generation characteristics of each SN are known, or can be probable. A set of K relay nodes (RSS) which can be additionally placed in the sensing ground.

These nodes do not create any, in turn, their only task is to forward data received from other nodes, therefore serving as a bridge between severed parts of the network and improving the quality of the paths used to route SN data. The nodes in the network commune with each other within the network communication ranger using a shared wireless strait. The problem which considers consists in result the optimal location for a maximum number K of RNs and determining routing paths from each SN to a BS to maximize the total set of connections throughput.

The way embark upon this objective is by minimizing end-to-end delays and the percentage of packet losses due to the characteristics of the shared middle. When no RNs are available to be deployed (K = 0), the problem becomes a real routing dilemma, and its solution provides the optimal data route. In the case the network is partially connected, the placement of RNs aims both to join the system and recover its routine. It does not require the placement strategy to deploy all the RNs available. In fact, in some suitcases, the maximal performance can be achieved using less than K RNs. Moreover, it does not confine the data to be transmitted over a single path; hence a data flow can be split over multiple paths.

In this come near revise by introducing link costs that take into account also other aspects (i.e., wireless channel access) other than just the hop count and add in the model several different components that closely model the characteristics of a wireless environment. In this system, an energy-efficient relaying scheme is proposed through a selection of mobile relays. The proposed project has several improvements compared to the conventional plans:

1. The requirement of providing a high quality of overhaul to customers leads to the necessity in dealing with the energy-performance trade-off, as destructive consolidation may lead to a routine using Energy competent and most exceptional (EEORNP) algorithm to allocate the resource the process to the requested source from the server poverty.

2. In this system, propose a novel draw near that for any known stationary workload, and a given state pattern optimally solves the problem of host overload detection by maximizing the stand for intermigration time and the traffic restrictions in under the memory judgment

3. Selection and situation of Relay Node critical aspect in the Cellular Network, Energy-Efficient scattered Relay Selection: Distributed Single Relay Selection (DSRS) algorithm and Distributed several Relay Selection (DMRS) algorithm for relay node collection.

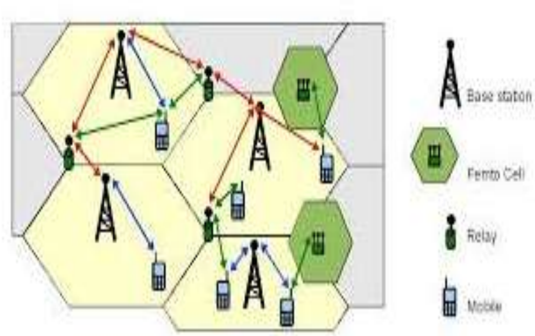

Figure 1: Green Cellular Network

This representation provides an overview of the design and optimization of green And Renewable Energy. Enabled itinerant networks, discusses the energy models for the analysis and optimization of the system.

II. RELATED WORKS

In force harvesting enable networks, the intermittent and randomly distributed renewable energy imposes severe challenges to supply the time-varying mobile traffic reliably. To tackle this issue, reshape the spatial renewable energy and free transportation by exploiting the approach of energy sharing and load altering, with the objective to minimize the grid energy expenditure of cellular networks powered by both grid and renewable energy. Formulate this problem as a mixed-integer non-linear indoctrination (MINLP), which is proved to be NP-hard. For centralized networks, first devise a cost-efficient centralized algorithm leveraging the univariate search technique, which can find the near-optimal solutions with the advantages of low complexity and fast convergence. Purposely, by jointly optimizing the spatial distribution of the renewable energy and mobile traffic, the central [1, 2] algorithm achieves a good match between the renewable energy supply and total power stipulate at each base station, such that the grid energy expenditure of the whole network is hugely concentrated. For distributed systems, further propose a three-phase distributed control policy, where base stations and mobile users adjust their strategies independently only with their local information.

Deployed long term evolution-advanced (LTE-A) infrastructure may need coverage extension due to the exponential growth of mobile broadband data usages as well as reduced network performance along the cell edges. A proper installation of relay nodes (RN) extends the network coverage in LTE-A networks. Propose an energy efficient and optimal RN placement (EEORNP) algorithm that maximizes the network coverage under the energy constraint, while maintaining the signal to interference ratio. The algorithm is based on an improved greedy algorithm, where an efficient and optimal RN [3] placement is guaranteed when the mastoid rank function of the energy efficient coverage extension optimization is sub modular and monotonic. The performance is investigated regarding coverage percentage and number of RN needed to cover users. Results show that the proposed EEORNP outperforms both greedy and random placement algorithms.

A single mobile beacon based method to localize nodes using a principle of maximum power reception is proposed. Optimal positioning of the mobile tag for minimum energy consumption is also discussed. In contrast to existing methods, the node localization is done with a prior location of only three nodes. There is no need for synchronization, as there is just one mobile anchor and each node communicates only with the anchor node. Also, this method is not constrained by fixed sensor geometry. The localization is [4] done in a distributed fashion, at each sensor node. Experiments on node-source localization are conducted by deploying sensors in an ad-hoc manner in both outdoor and indoor environments. Localization results obtained herein indicate a consistent performance improvement when compared to conventional methods.

Discrete relay assortment procedures based on mathematical Channel National Information (CSI) in amplify-and-forward style are future, aiming to exploit vig or capability. By the limited CSI, a tradeoff is made among the total power ingesting then the target outage likelihood at the source. A proceeding threshold is got by diminishing the regular force. Each communicates individually decides whether to participate in promoting the basis signals rendering to the advancing limit.[5] Firstly, a Dispersed Multiple Relay Variety (DMRS) algorithm is proposed, in which all applicant relays have the option of conveying the basic signs, and the threshold is obtained by the arithmetical search. Then a Distributed Solitary Communicate Selection (DSRS) procedure with low complexity opinions examined under the assumption that only one communicate onwards the signals. Simulation results indicate that the proposed algorithms provide significant performance gain regarding energy efficiency over the existing AF-mode relay selection algorithms.

Cellular operators are progressively turning to renewable energy (RE) as another to using traditional electricity to reduce working expenditure and carbon footprint. Due to the randomness in both RE generation and moveable traffic at each base station, a surplus or shortfall of energy may occur at any given time. To increase energy self-reliance and minimalize the network's energy cost, the operator needs to efficiently [6, 7] exploit the RE generated across all BSs. In this paper, a hybrid energy distribution framework for the cellular network is proposed, where a mixture of physical control lines and energy interchange with other BSs using the keen grid is used. Algorithms for physical power lines deployment between BSs, based on even and complete statistics of the net RE obtainable, are developed. Later, an energy organization framework is formulated to control the quantities of power optimally then RE to be procured then exchanged among BSs, respectively, though seeing cordless capacities then real-time energy pricing. Three cases are inspected anywhere RE cohort unknown, flawlessly recognized, formerly partly is known ahead of time. Results examine the time-varying potency management of BSs and demonstrate the considerable reduction in average vigor cost thanks to the hybrid energy sharing scheme.

Energy efficiency has developed one of the critical tests for a large class of electric systems. Longer time between battery recharges extremely desirable for battery-powered devices such as mobile phones, digital cameras, Internet tablets, and electronic managers. Energy efficiency is also essential for electronic systems [7, 8] powered through the electric grid since it may reduce power consumption and the cooling requirements. Power investments are likely because electrical systems have an idle state, when, for example, the computer can track in a low-power nationwide. Thus, the correct approximation of the workload model theatres an essential part in the decision of which and when a power state transition should be performed by the electronic system. This paper introduces a multisite sliding window workload estimation technique for dynamic power management (DPM) in non-stationary environments. This method reduces both the effects of identification delay and sampling error present in the previous fixed-size sliding window approach. The system is modeled by discrete-time Markov chains, and the model offers a rigorous mathematical preparation of the problematic and lets one to obtain an excellent trade-off between presentation and power ingesting.

LTE is a latest cellular system, it is standardized by 3rd Generation partnership project (3GPP), and it is employed to satisfy increasing client demand for high-speed services also to fulfill the need for user knowledge with full mobility. With the ever-growing demand for data applications, old-style cellular grids face the trials of if improved system capacity, extended cell coverage, and improved[9,10] minimum quantity in a cost-effective manner. Wireless relay stations, chiefly when functioning in a half-duplex operation; make it possible without incurring high site acquisition. Design of wireless attach stations faces the many tests of if retrograde compatibility, minimalizing complexity, and exploiting efficiency.

III. IMPLEMENTATION OF PROPOSED METHODOLOGY

In this approach revise by presenting link costs that take into explanation also other aspects (i.e., wireless channel access) other than fair the hop total and add in the model numerous different components that closely model the countenances of a broadcast setting. In this scheme, an energy-efficient relaying arrangement is future finished the selection of moveable relays. The proposed project has several developments compared to the conformist plans.

The main contributions of this paper are:

i. The obligation of providing the high quality of service to customers leads to the necessity in dealing with the energy-performance trade-off, as aggressive consolidation may lead to performance using Energy Efficient and Optimal (EEORNP) algorithm to allocate the resource the process to the requested source from the server degradation.
ii. In this system, propose a novel approach that for any known stationary workload and a given state configuration optimally solves the problem of host overload detection by maximizing the mean intermigration time and the traffic restrictions in under the memory assessment
iii. Selection and placement of Relay Node critical as pectin the Cellular Network, Energy-Efficient Distributed Relay Selection.

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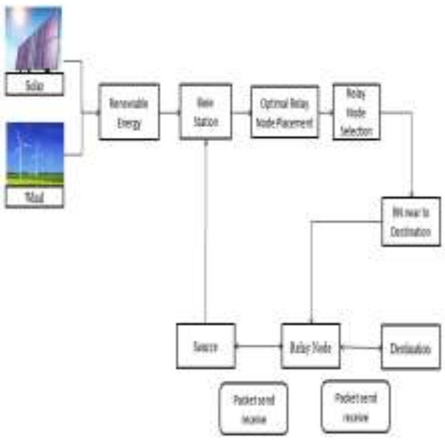


Figure 2: Proposed system architecture

Distributed Single Relay Selection (DSRS) algorithm and Distributed Multiple Relay Selection (DMRS) algorithm for relay node selection.

1) Energy Efficient and Optimal Relay Node Placement (EEORNP)

This section extends the results of the previous section by removing the restriction of predetermined locations for the relay nodes. The topology information of the sensor network is represented by G = (V, E). The fixed locations of the AP and sensor nodes are given by Ls = {l1, l2, ..., lN} whereas the variable locations of the relay nodes are given by Lr = {lN+1, ..., lM}. Notice that the transmission power associated with a link (i, j) ∈ E is variable if either i or j or both are relay nodes.

Algorithm 1:

Minimize

i=1

Subject to: j >= 0 for i, j ∈ [1,M]

ei>= 0 for i ∈ [1,M]

_jfij − _jfji = gi tt for i ∈ [2,N]

_jfij − _jfji = 0 for i ∈ [N + 1,M]

td(_jptx,Kijiji + _jprxfji) <= I for i ∈ [N + 1, M]

pix,it = ptd(i, j)) for i, j ∈ [1,M]

d(i, j)2 = |li − LJ |2 for i, j ∈ [1,M]

2) Node Placement Algorithm

Node placement is a technique to place the nodes effectively in a simulation area to conserve the minimum energy from each node that is intended for transmission of packets or data. Most of the network considers a communication by deploying the nodes randomly. When the nodes are used randomly, three issues mainly are, some nodes are densely disposed at particular region while the other part has got fewer nodes located at farther distances and leaving region will not at all be with the single coverage of node. The drawbacks of such random node deployment are that nodes with the dense location, where routing is to take place. All the hops between Source and destination in a region of compact location of nodes take part in routing leading to additional utilization of energy from each node, whereas in the case of nodes at a far place, extra power again is to be spent in transmitting the data to neighbors as well to the destination located at far distances. Similarly, it is difficult to manage the routing in a region where no nodes are located leading in all the three case, an uneven distribution of energy source and node deployment.

For each relay node, i ∈ Vnr add one relay node at each of the vertices corresponding to node I to Vg if it is not already in Vg if (i, j) ∈ Enr((j, i) ∈ Enr) and node j is a sensor node or relay node that has already been processed add a directed arc between the closest nodes corresponding to node i and j to Eg with the corresponding For each relay node, i ∈ Vnr determine the excess each corresponding relay node ∈ Vg solve the resulting transportation problem by assigning flows along the shortest path between these relay nodes updated with the resulting floods from the transportation problem.

3) Energy-Efficient Distributed Relay Selection algorithm

The proposed work is intended to develop Energy Efficient Distributed Relay Selection to place the sensor node efficiently in the simulated area, where all the nodes are equally located on a radial path to cover the maximum area at equidistance. The total energy consumed by each node compared to random placement of nodes is less by having an equal burden on fewer nodes of remote location, having distributed the nodes in the whole of the simulation area. Thereby calculating the network lifetime which also proves to be useful as compared to random placement of nodes, hence increasing the network lifetime too. Simulation is carried out in a quaint simulator; results are obtained on par with the random arrangement of nodes with Distributed Relay Selection algorithm.

Algorithm 2:

Input:

G = (V, E,!): Weighted communication graph, where E = ESS [ESY [ESB [EYY [EYB

B: Set of base stations.

S: Set of sensor nodes in the network.

Y: Set of candidate relay nodes in the network.

ASTP(G, !, S): An approximation algorithm to obtain a Steiner tree from the weighted graph where S is the source nodes.

Output:

R: The set of relay nodes positions that should be activated.

1: Parent = {};

2: for all sn 2 S do

3:!min = 1;

4: for all (sn, bst) 2 ESB do

5: if !min > !sn,bst then

6: !min = !sn,bst;

7: Parent[sn] = bst;

8: end if

9: end for

10: if !min , 1 then

11: V = V \ {sn};

12: end if

13: end for

14: S rc = ;

15: while S \ V , ; do

16: A = 1;

17: snN = ;;

18: nb! = 1;

19: for all rly 2 Y \ S rc do

20: snNrly = N(G, rly) \ S; // N(G, rly) is a function that returns the neighbors of rly in G.

21: if (size(snNrly) > size(snN) _

(size(snNrly) = size(snN) ^ nb! > n2sPnNrly

!n,rly) then

22: A = rly;

23: snN = snNrly;

24: nb! = n2sPnNrly !n,rly;

25: end if;

25: end if

26: end for

27: if A , 1 then

28: S rc = S rc [{A};

29: for all sn 2 snN do

30: V = V \ {sn};

31: Parent[sn] = A;

32: end for

33: end if

34: end while

35: S rc = S rc [B;

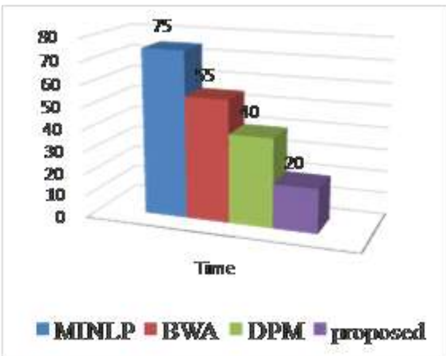
36: (V, E) = ASTP(G, !, S rc);

37: R = V \ Y;

IV. RESULTS AND DISCUSSION

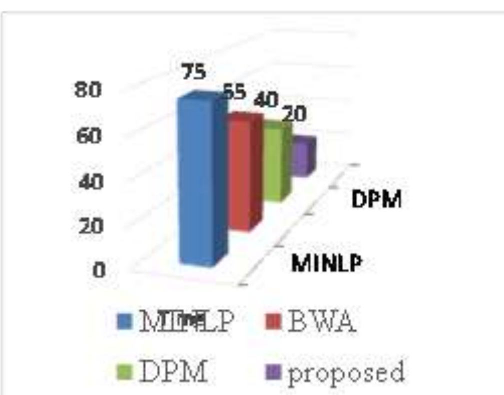
The obligation of providing a high quality of service to customers leads to the necessity in dealing with the energy-performance trade-off, as aggressive consolidation may lead to performance. Using Energy Efficient and Optimal RN Placement

(EEORNP) algorithm to allocate the resource the process to the requested source from the server degradation Current solutions to the problem of host overload detection are generally heuristic based, or rely on statistical analysis of historical data. Heuristically adapt the EEORNP algorithm to handle unknown no stationary workloads using the Multi-size Sliding Window workload estimation technique.



Graph 1: Time Complexity of Proposed System

Figure 1 shows the privacy level at the expansion of a connection that achieves lower time complexity compared to existing system. This provides an overview on the design and optimization of grid energy enabled mobile networks, discusses the energy models for the analysis and optimization of the fibers, and lays out basic design principles and research challenges on optimizing the grid energy powered mobile networks. Energy-Efficient Distributed Relay Selection: Distributed Single Relay Selection (DSRS) algorithm and Distributed Multiple Relay Selection (DMRS) algorithm for relay node selection.



Graph 2: Shows the Accuracy Key Log Relational Analysis

Figure 2 shows our evaluation results suggest that overall accuracy is well-suited for integration in existing systems since it incurs less than 5% overhead compared to existing semantically secure encryption modes.

V. CONCLUSION AND FUTURE WORK

In this method, investigated the benefit of improving energy efficiency with relaying for cellular networks. Two issues are jointly considered: RN placement and RN sleep organize. The detailed structure of the optimal RN placement for pure show power minimization is provided. It also presents an algorithm to deal with the interaction between RN placement probability part, which aims at minimizing the total power utilization, including the transmission power and the circuit power of active RNs. They have found that the power saving gain led by insertion RNs optimally increases with the path-loss exponent. It has also been shown that fixing the RN placement that minimizes the transmission power and optimizing the RN active probability according to load conditions can be a good tradeoff between practicality and performance. In this paper, we reviewed techniques for saving power consumption and improve energy efficiency in base stations. However, there are still many technical challenges for base station architecture redesign, heterogeneous Network deployment, radio resource management, etc. that need to be addressed for energy efficient base stations.

In the future, we will test our approach using real WSNs and mobile robots, and we will work out its evolution into a fully distributed scheme. On-line estimators will be considered to measure node positions, link costs, and traffic loads.

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