A Novel Cross Layer Approach for Minimizing Energy Utilization for Mobile Wireless Sensor Networks

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Abstract

Wireless Sensor Networks (WSNs) consist of densely distributed sensor nodes with embedded low computational power CPU, limited storage and low power radios. WSNs are widely used to monitor environmental conditions, such as temperature, sound, and vibration and pressure, in disaster relief, home monitoring etc. One major disadvantage in Mobile WSNs suffers from over head of control packet and decreases the sent packet ratio. This leads to consume more energy. The paper introduces a cross-layer operation model that can increase the utilization of energy and provide high throughput of MWSNs. The model integrates four layers in the network operation: 1) application (location of node); 2) network (flooding); 3) medium access control (MAC); and 4) physical layers. The location of the mobile nodes is implanted in the routing operation after the discovery of route. The location information is then utilized by the MAC layer transmission power control to adjust the transmission range of the node. This is used to minimize the power utilized by the network interface to reduce the energy consumption of the node(s). The model employs a mechanism to minimize the neighbor discovery broadcasts to the active routes only. Reducing control packet broadcasts between the nodes reduces the network’s consumed energy. Through simulation-based evaluations, the proposed model outperforms the conventional operation of IEEE 802.15.4-based network and the energy efficient and QoS aware multipath routing protocol in terms of energy consumption by roughly 10%, twice less control packet overhead, end-to-end delays and comparative packet delivery ratios.

Keywords: Cross layer design, energy efficiency, mobile nodes, wireless sensor networks, sensor system networks

I. INTRODUCTION

Wireless A Wireless Sensor Network (WSN) contains of spatially spread self-directed sensors to monitor physical or environmental circumstances, such as heat, sound, weight, etc. and to cooperatively pass their data through the network to a main location. Now-a-days the modern networks are bi-directional, also enabling control of sensor activity. The development of wireless sensor networks is widely used by military applications such as battlefield surveillance and also used in many industrial and end user applications, such as business process control process control machine operation control and so on. Applications of WSN are not limited to these fields but can be expanded in other areas like environmental/earth monitoring, area monitoring, monitoring quality of air, landslide detection, testing quality of water, interior monitoring, exterior monitoring, air pollution detection, forest fire detection, prevention of natural disaster, industrial monitoring, agriculture, monitoring smart home etc.

The characteristics of WSN highlights the limited life time of sensor by use of limited battery backup. To save energy the cross layer approach is used where it maintains neighbor node list (NB) which avoid sending control packets every time before sending original data to the destination node. Cross layer network model consist of four layers namely application layer, network layer, medium access control layer and physical layer. Each layer has its own functionality where application layer is used to deploy the nodes in network, the network layer is used to data transfer it is also called as routing, where MAC and physical layers are for actual transmission and power control. Maintaining the NB list is very helpful to discard the more number of hello packets, which will decreases the delay, the energy of nodes is saved and increases throughput. The neighbor node list will find out the optimum route to the destination with minimum number of hops.

The further part of the paper has been organized as follows: Section II deals with the previous related work. The section III gives overview of system design of proposed work. Next section IV specifies data flow for proposed technique. Section V highlights the result. Section VI concludes the paper with future work.

II. LITERATURE SURVEY

C. K. Ng et al. [1] He explains Portable Wireless Sensor Network is having versatile hubs in the system. Both the sensor hubs and versatile sink can be portable or there can be blended sensor hubs i.e. versatile and static sensor hubs in the system taking into account the application necessities. Directing in portable remote sensor system postures research issues as hubs are versatile,
so it needs to send the information as indicated by the steering convention while it is moving. So the steering conventions have been gives considering versatile hubs in the system concentrating on examination issues like parcel misfortune, vitality utilization, and postponement. In this paper, the group based directing conventions that have been gives for portable remote sensor system are talked about and examination is done among them.

A. Dunkels et al. [2] explains Remote sensor systems are made out of expansive quantities of little arranged gadgets that impart unhindered. For expansive scale systems it is critical to have the capacity to progressively download code into the system. In this paper System show a light System might work framework with backing for element stacking and substitution of individual projects and administrations. It is worked around an occasion driven portion System over gives discretionary preemptive multithreading that can be connected to individual procedures. Systems demonstrate that dynamic stacking and emptying is obtainable in an asset obliged environment, while keeping the base framework light System might and conservative.

J. Laneman et al. [3] They make and explore less power supportive contrasting qualities traditions that fight obscuring incited by multipath expansion in remote frameworks. The shrouded strategies abuse space grouped qualities available through taking an interest terminals' giving off signs for each other. We chart a couple of methods used by the taking an interest radios, including modified exchanging plans, for instance, strengthen and-forward and disentangle and-forward, determination giving off arrangements that change based upon channel estimations between the teaming up terminals, and incremental giving off arrangements that modify based upon limited contribution from the destination terminal. We make execution depictions to the extent power outage events and related power outage probabilities, which gage quality of the transmissions to obscuring, focusing on the high banner to-tumult extent organization. Beside changed translate and-forward, most of our supportive varying qualities traditions are capable as in they fulfill full grouped qualities, and, furthermore, are close perfect in particular organizations. Thusly, using spread receiving wires, we can give the able focal points of space contrasting qualities without necessity for physical displays, however at lost ghost profitability in view of half-duplex operation and possibly to the detriment of additional get gear. Material to any remote setting, including cell or extraordinarily named frameworks wherever space constraints obstruct the use of physical shows—the execution depictions reveal that significant power or imperativeness hold reserves result from the use of these traditions.

A. E. Khandani [4] Author think about the issue of transmission-side arranged qualities and coordinating in a static remote framework. It is normal that each center point in the framework is equipped with a singular all angle signal receiving wire and that different centers are allowed to arrange their transmissions remembering the deciding objective to obtain essentialness stores. We decide intelligent results for achievable imperativeness save reserves for both line and network framework topologies. It is exhibited that the essentialness speculation assets of and are achievable in line and framework frameworks with a generous number of center points, independently. Then develop a dynamic-programming-based figuring for finding the perfect course in a subjective framework, and likewise flawed computations with polynomial disease quality. We show up through amusements that these counts can finish typical essentialness venture assets of about in self-assertive frameworks, when stood out from the noncooperative arrangements.

Z. Han et al. [5] Starting late, pleasant controlling in remote frameworks has expanded much eagerness due to its ability to manhandle the broadcast method for the remote medium in sketching out power efficient coordinating figuring’s. A huge part of the current cooperation based directing figuring’s are executed by finding a shortest_path course first. In light of current circumstances, these guiding counts don’t totally manhandle the advantages of pleasant trades at the physical layer. In this paper, we propose a joint effort based guiding estimation, particularly, less power utilization figuring, which makes full use of the pleasing exchanges while building up the base compel course. The module computation builds up the base drive course as a course of the base power single-hand-off building ruins from the source to the destination. From this time forward, any dispersed shortest_path computation can be utilized to find the perfect course with polynomial multifaceted nature, while guaranteeing certain throughput. We exhibit that the module estimation can perform power saving of less appeared differently in relation to the standard most short way controlling counts. In addition, the MPCR estimation can finish power saving of more less diverge from the current supportive coordinating computations, in which the picked courses are created in perspective of the noncooperative courses.

M. J. McGlynn et al. [6] The system address two issues connected with static impromptu remote systems; strategies for sparing vitality amid a sending of the hubs, and proficient techniques for performing nearby neighbor revelation. To meet these objectives System presents a position of birthday set of rules which apply uneven autonomous transmissions to find adjoining hubs. Different methods of the birthday convention are utilized to take care of the two issues. System gives a numerical model and examination of two methods of the convention and is directed to a third mode which is the probabilistic simple of the deterministic round robin planning calculation. System appear by examination and recreation that the birthday conventions are a promising apparatus for sparing vitality amid the organization of a specially appointed system and a productive and adaptable method for having the hubs find their neighbors.

R. Zheng et al. [7] Explains because of the moderate headway of battery innovation, prosystem administration in remote systems stays to be a basic issue. In this paper, System contemplate diverse nonconcurrent wakeup systems which have the merits of not requiring worldwide clock synchronization and being resent to network flow. System define the wakeup plan as a square outline issue in combinatory and infer hypothetical limits for both symmetric and awry correspondence model. Taking into account our ideal piece plan for symmetric correspondence model, System gives a nonconcurrent wakeup convention comprising of three sections: neighbor disclosure, expectation and reservation. The key thought behind the convention outline is to decouple the wakeup plan out of gear states from the real obligation cycle of a hub when there is information transmission.
Reenactment ponders show the adequacy of our convention under different movement qualities and burden. Vitality sparing under our gives configuration and convention can be as high as 60%, while the productivity of information correspondence is negligibly affected.

Jhumka et al. [8] Explains Remote sensor systems (WSNet) are portrayed by confined communications. In fact, a few WSN calculations and conventions work in a decentralized manner by organizing hubs inside the remote correspondence range, e.g., restriction calculations and M_A_C conventions. In any case, frequently these components don't address blames that may influence the way remote neighborhoods are perceived by hubs, e.g., as on account of information debasement. As the operation of these components is established in the utilization of topology data, these flaws might be a huge impairment to right and productive framework operation. In this paper, System contend that the above issues are specific occasions of a general issue of reliable neighborhood view. System display three progressively System maker particulars of the issue. Next, System demonstrate the invalid possibility of tackling the two more grounded details, and give a calculation to explain the System meekest particular. Also, System actualize our calculation in a regularly utilized WSN system stack, and survey its execution both in reproduction and in a certifiable test bed. The outcomes demonstrate that, when conceivable, our systems proficiently tackle the issue of steady neighborhood view, giving more elevated amount instruments a re-usable building piece to influence off.

Dunkels et al. [9] explains sensor systems move towards expanding heterogeneity, the quantity of connection layers, M_A_C conventions, and hidden transportation instruments increments. Framework designers must adjust their applications and frameworks to suit an extensive variety of hidden conventions and instruments. In any case, existing correspondence models for sensor systems are not intended for this heterogeneity and along these lines the framework designer must redevelop their frameworks for each fundamental correspondence convention or instrument. To cure this circumstance, System exhibit a correspondence engineering that adjusts to an extensive variety of hidden correspondence instruments, from the M_A_C layer to the vehicle layer, without requiring any progressions to applications or conventions. System demonstrates that the engineering is sufficiently expressive to oblige regular sensor system conventions. Estimations demonstrate that the expansion in execution time over.

III. System architecture

WSN is widely used N/W in present era which is having less battery power and life time. To save the energy of node and increase the life time of node the cross layer network model is very helpful. The architecture of the proposed model is show in below diagram.

![Architecture of the system](image)

Fig. 1: Architecture of the system

The above diagram gives the overall architecture of the given system where different nodes are depicted.
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A. Data Flow Diagram

![Data Flow Diagram]

Fig. 2: Data Flow Diagram.

Above operational model explains the work carried out by the cross layer network model in cross layer model before sending the request message the neighbor node list is updated and then it sends hello packet only ones to initiate the network. The neighbor node list helps to find the path to destination node with minimum number of intermediate node.

The path to destination is displayed in reverse order. The list is updated periodically. Distance is calculated to destination and the transmission power is adjusted.

IV. METHODOLOGY

Existing System experience the ill effects of control packet overhead, sending more number of control packet before sending actual data will consume more energy and increases delay in sending data also diminishes throughput of network, where in WSN nodes have minimum battery power and life time. The proposed Here the cross-layer operation model is defined. In first phase the mobile node broadcast the neighbor selection message to collect and update the neighbor list. After the initialization process, if any node has the data to send then the location of the mobile node is affix whit the data. GPS gives the hub position or other routine can likewise be utilized to finds the area of the hub. Subsequent to finding the area the hub begins sending demand message to destination hub for way foundation. Hi bundles are additionally called as show parcel it is utilized to redesign the neighbor list.

Advantages of proposed system are:
1) The proposed cross-layer presumes no clustering method has been implemented. It provides flexibility to the network when new nodes are added.

2) The proposed system gets better the energy utilization and higher throughput.

Below section shows the different modules used in the proposed system.

**A. Network configuration:**

Sensor hubs are haphazardly conveyed in the detecting field. In this anticipate System are utilizing remote sensor system. In this system, the hubs are static and settled. The sensor hubs are sense the data and afterward send to the server. On the off chance that the source hub sends the parcel, it will send through the middle of the road hub. The hubs are imparts just inside the correspondence range.

**B. Energy Model:**

Here minimizes the vitality utilization at a few levels: The neighbor disclosure parcels are required just at the introduction procedure of the system to manufacture the adjacency metrix. Subsequent to instating the system, neighbor revelation parcels are not should have been telecast any longer in light of the fact that the System come bundles intermittent TV will keep up the neighboring hubs for the dynamic course.

Knowing the area of the following jump to conform the transmission force decreases the force expended if the separation betSystemen the hubs in reach is short. Communication convention system starts the transmission of info with power of the system for the hub the length of the transmission_power (T P) needed will not surpass the transmission range. Model Evaluation Environment. Intermittent hi bundle TV gets to be constrained to just the hubs required in the set up course. Occasional hi bundles are additionally inhibited to the life time of the lane recognized. System and M_A_C layers to accomplish the changes as far as the vitality utilization of the system as a rule. The transmission poSystem control component is initiated just at the information transmission state to dodge problematic availability betSystemen the hubs at other system states (joining, course foundation ... and so on.).

**C. Model Evaluation:**

Broad reproductions are shown to assess the Cross_layer approach. The situations had a sending range of 250 × 250. The hubs conveyed Systemre all portable with a stationary sink hub set amidst the reenactment territory. There Systemre seven information sources haphazardly decided for the greater part of the situations. The majority of different source_hub their information to the sink hub. The applications began sequentially for every source_hub with 11 seconds contrast betSystemen every source application begin time. The givesd operational model devourd vitality System than the standard scheme model. The vitality utilization per parcel was additionally method for the cross layer. The low vitality expended per parcel was on the grounds that the bundle conveyance proportion. The system vitality utilization was System in light of the fact that the cross layer utilizes transmission power and network maintenance power. Power required for the information transmission control system had its most reduced impact at the least number of sent hubs as the severance bet Systemen the focal point System higher. At the point when the quantity of sent hubs expanded, the vitality utilization hole expanded. This implies the transmission structure control was producing its results as the division bet Systemen the node got to be shorter.

**D. Performance Evaluation:**

In this area, System can assess the execution of reproduction. System are utilizing the x_graph for assess the execution. System utilize some assessment measurements: Packet conveyance proportion: – it is the proportion of the quantity of parcel got at destination and number of bundle sent by the source. Throughput: The throughput metric spoke to the framework information efficiency amid the system operation. Framework throughput was spoken to by the measure of information that was conveyed from a source to a destination amid a timeframe. End-to-End delay: - the normal time taken for a parcel to be transmitted from source to destination. Energy level – number of vitality devourd when the information ought to be transmitted. Vitality Consumption: The vitality utilization per round is the total of vitality devourd per round. System in this manner considers the vitality utilization as the vitality dispersed in transmitting and accepting parcels.

**V. RESULT AND DISCUSSION**

The effectiveness of proposed technique has been evaluated using simulations that were performed by developing discrete event object oriented network simulate in NS2.
The above graph explains the energy utilization scheme of the given system with existing methodology. As we can see the given system utilizes very less amount of energy compared with already available schemes.

The above screen shot gives the detailed graphical way of delay comparison with IEEE 802.15.4 based model, as we can see the delay is very less with CLNM.
Above graph displays the increased throughput of proposed system where the throughput of the existing system is low and the old system suffers from delay because of control packet overhead.

This gives the packet transmission ratio the given system sends more packets within a given time than any of the other scheme available. The minimum delay will increase the packet delivery ratio.

VI. CONCLUSION

This framework gives a simple but effective cross layer network model for mobile wireless sensor networks. The model uses two approaches: the first mechanism is to control the hello packet transfer and make the communication network to be free for
transmission. Minimizing control packet broadcast mainly focuses on neighbor discovery at the Medium access control layer and sending hello packet to its neighbor in the routing layer. The second method is to control the transmission power which is based on the location of the node. The second method is active only when the route is established. Combining both mechanisms provides saving the energy, results in higher throughput and lesser delay. The main aim is to minimize the large number of control packets like requesting the route (RREQ) and reply for the route (RREP). Here, neighbor node list provides sink node location easily. The directional packet sending will minimize control packet broadcast and improves quality of the channel and increases the nodes' life time.

REFERENCES