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A Multi-Parameter Scheme to Enhance a Network Life in Wireless Sensor Network's

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Abstract— It works on the routing in the WSN using the shared cache memory. The existing approach of routing in WSN works on centralized basis. The local source node transmits data to its cluster head then the cluster head transmits data to the base station. The base station transmits the data to the cluster head of the cluster containing the destination. The base station is the center that contains all the information in this approach. In the existing approach if base station fails then no communication can occur. The proposed technique removes this drawback by providing a shared cache memory to the each cluster head. Each node transmitting data to its cluster head updates the cache. As the cache memory is shared so the transmission between one cluster updates the cache memory for each cluster head. The source nodes add address of destination in its packet and transmits data to its cluster head. It updates the cache of each cluster. The cluster head then transmits to cluster head of the cluster containing the destination node. Then the cluster head transmits the data to destination. The simulation result shows the better performance of the proposed work in terms of the delay and the distance covered.

Keywords— *WSN, Cooperative cache, Cluster , Cache Replacement policy, Multiprogramming time sharing scheduling*

I. INTRODUCTION

Wireless Sensor Networks (WSNs) are a new technology which is increasingly in the future due to their data acquisition and data processing abilities. A sensor network is a collection of communicating sensing devices, or nodes. All of the nodes are not necessarily communicating at any particular time, and nodes can only communicate with a few nearby nodes. The network has a routing protocol to control the routing of data messages between nodes. The routing protocol also attempts to get messages to the base station in an energy efficient manner. The base station is a master node. Data sensed by the network is routed back to a base station. The base station is a larger computer where data from the sensor network will be compiled and processed. The base station can be thought of as a controller for the sensor network. It is the source of instructions concerning the type of phenomena to be sensed, and it collects all results. The concept of wireless sensor networks is based on a simple equation:

Sensing + CPU + Radio = Thousands of potential applications. As soon as people understand the capabilities of a wireless sensor network hundreds of applications spring to mind. It is straightforward combination of modern technology.A sensor network is a collection of communicating sensing devices, or nodes. All of the nodes are not necessarily communicating at any particular time, and nodes can only communicate with a few nearby nodes.

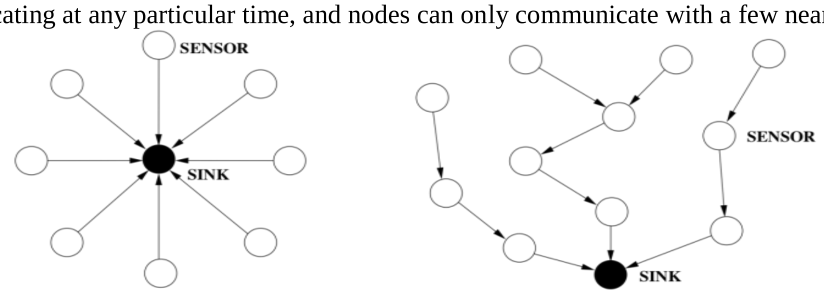

Figure 1:Wireless Sensor Network

Sensing is a technique used to gather information about a physical object or process, including the occurrence of events (i.e., changes in state such as a drop in temperature or pressure). An object performing such a sensing task is called a sensor. For example, the human body is equipped with sensors that are able to capture optical information from the environment (eyes), acoustic information such as sounds (ears), and smells (nose).

A sensor is a device that translates parameters or events in the physical world into signals that can be measured and analyzed. Another commonly used term is transducer, which is often used to describe a device that converts energy from one form into another. A sensor is a type of transducer that converts energy in the physical world into electrical energy that can be passed to a computing system or controller.

II. CHALLENGES OF WSN

1) Node deployment

It affects the performance of the routing protocol. The deployment can be either deterministic or randomized. In deterministic deployment, the sensors are manually placed and data is routed through predetermined paths. In random node deployment, the sensor nodes are scattered randomly creating an infrastructure. If the resultant distribution of nodes is not uniform, optimal clustering becomes necessary to allow connectivity and enable energy efficient network to operate. Inter-sensor communication is normally within short transmission ranges.

2) Energy consumption without losing accuracy

Sensor nodes can use up their limited supply of energy performing computations and transmitting information in a wireless environment. As such energy conserving forms of communication are essential. Sensor node lifetime shows a strong dependence on the battery lifetime. In WSN, each node plays a dual role as data sender and data router.

3) Data Reporting

It is dependent on the application the time criticality. Data reporting can be categorized as either time, event driven, query driven and hybrid. The time-driven delivery model is suitable that require periodic data monitoring. As sensor nodes will periodically switch on their sensors and transmitters, sense the environment and transmit the data at constant periodic time intervals. In event driven and query driven models, sensor nodes react immediately to sudden changes in the value of a sensed attribute due to the occurrence of a certain even or a query is generated by the BS.

4) Fault Tolerance

Some sensor nodes may fail or be blocked due to lack of power, physical damage, and environmental interference. The failure of sensor nodes should not affect the overall task of the sensor network. If many nodes fail, MAC and routing protocols must accommodate formation of new link and routes to the data collection base stations. More energy is available to sensor network which is a challenge in wireless sensor network.

5) Scalability

The number of sensor nodes placed in the sensing area may be in the order of hundred, thousands. Any routing scheme must be able to work with this huge number of sensor nodes. Sensor network routing protocols is scalable enough to respond to events in the environment. Until an event occurs, most of the sensors can remain in the sleep state, so scalability is also a tough challenge.

6) Transmission media

In sensor network, communicating nodes are linked by a wireless medium. The traditional problems associated with a wireless channel e.g., fading, high error rate may also affect the operation of the sensor network.

7) Coverage

In WSNs, each sensor node obtains a certain view of the environment. A given sensor’s view of the environment is limited both in range and in accuracy; it can only cover a limited physical area of the environment. Hence area coverage is also an important challenge in WSNs.

III. RELATED WORK

In Year 2012, Ioannis P saras performed a work," Probabilistic In-Network Caching for Information-Centric Networks". In this paper, Author are concerned with cache management operation that is adjusted to fit in completely decentralized and uncoordinated environment we focus on fair sharing of availability cache capacity of path.the author assumes system model containing path cache capacity,path cache capability ,symmetric path ,path length monitoring this paper estimate the cache capability by using time in factor. Presented goal is to reduce caching redundancy and make more efficient utilisation of available cache resources along a delivery path. We have proposed probcache an algorithm that approximates the capability of path to cache contents. Presented in-network caching scheme taking several parameters such as content request distribution, catalog size, cache replacement policies [2].

In Year 2008, Sheetal Gupta performed a work," QueryDistributionEstimationandPredictiveCachingin Mobile Ad Hoc Networks". Author proposed that mobile devices dynamically estimate global query distribution. They use estimate global query distribution to predict and cache the popular data.this increases the data availablility in network. We experimented with different cache replacement policies for caching of pushed data. It involves a local distributed technique for estimating global query distribution in the network. The devices have a finite sized cache to store the pushed data and use their estimation of queries for prioritizing the data to cache. [3]

In Year 2011, Naveen Chauhan performed a work," A Cooperative Caching Strategy in Mobile Ad Hoc Networks Based on Clusters". Author present a scheme, called global cluster cooperation for caching in mobile ad hoc networks where network topology is partitioned into non-overlapping clusters based on the physical network proximity. In this scheme cluster cache state which is the information regarding the contents of all the mobile node within a cluster, is maintained at each node. In case of cluster cache miss, Author propose to keep global cache state at a node called cluster state node (CSN).[5]

In Year 2012, John Ardelius performed a work," On the Effects of Caching in Access Aggregation Networks". In this work, Author develop an analytical model of an aggre- gation access network receiving a continuous flow of requests from external clients.the purpose of this paper is to introduce tool or analytical model in network centric for large scale contents and this tool is used to provide assessing the load on cache and estimate availablitiy of data Author provide exact analytical solutions for cache hit rates, data availability and more. Thiscaching is applied to video on demandin order to show bandwidth saving. [8]

In year 2013, S.A.V. SatyaMurty performed a work,"real time packet scheduling for real time wireless sensor network". This paper proposes to minimize the end to end delay with required bounded time constraints. Real time packet scheduling scheme is to schedule the incoming packets effectively based on their deadline. Proposed work compare effective real time packet scheduling and just in time scheduling. The result shows that proposed scheduling policy works better in terms of average delay,packet drop ratio,packet miss ratio.[14]

IV. PROPOSED SCHEME

Basic terminology used in proposed work

1) Life time

Critical to any wireless sensor network challenge is the expected lifetime. The primary limiting factor for the lifetime of a sensor network is the energy supply. Each node must be designed to manage its local supply of energy in order to maximize total network lifetime. In many deployments it is not the average node lifetime that is important, but rather the minimum node lifetime. In the case of wireless security systems, every node must last for multiple years. A single node failure would create a vulnerability in the security systems. In most application scenarios, a majority of the nodes will have to be self powered.

2) Cache Memory

Cache memory is small amount of fast memory that sits between normal main memory and network which may be located as private or the global cache. The effectiveness of the cache operation is based on a property of network called locality of reference or locality principle. Analysis of programs shows that most of the program time is spent on executing many instructions repeatedly. These instructions may be a simple loop, nested loops that repeatedly call each other. Many instructions in localized areas of the program are executed repeatedly during some period of time, and the remainder of the program is accessed relatively infrequently. This is referred to as locality of reference.

Locality of reference happens in two ways: temporal and spatial. Temporal locality means that a recently referenced memory word will be referenced again very soon. Spatial locality means that memory words close to recently referenced memory word will be referenced soon.

3) Cache Write Operations

When the word to be updated is found in the cache (cache hit), then either one of the two write policies are used: Write through and Write back.In write through, all write operations are made to the main memory as well as to the cache. This will ensure that the content of the main memory is consistent with the cache content always. The main disadvantage is that it generates a lot of memory traffic especially when a given word is updated several times during its availability in the cache. This will slow down the memory write operation.In write back, updates are made only in the cache. When an update occurs, an UPDATE bit associated with each cache line (block) is set. Then when a block in the cache is to be replaced, it is written back to main memory if and only if the UPDATE bit is set. The disadvantage of the write back is that not all the main memory content is consistent with the cache content. All access by I/O devices should be done through the cache and this requires complex circuit.If the word to be updated is not found in the cache (cache miss), then if write through protocol is used, the update is done directly in the main memory.

4) Scheduling

Scheduling mechanism is the most important component of a computer system. Scheduling is the strategy by which the system decides which task should be executed at any given time. There is difference between real-time scheduling and multiprogramming timesharing scheduling. It is because of the role of timing constraints in the evaluation of the system performance. Multiprogramming time sharing scheduling is used in this proposed work.

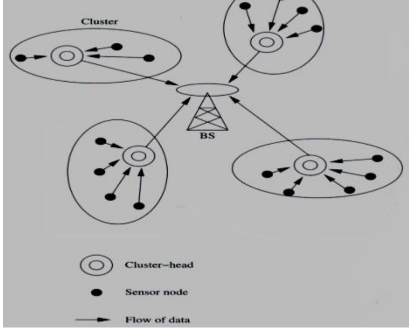

Figure 2: Clustered Architecture

5) Single Shared Ready Queue

It is a simple approach. A single global queue shared by all the processors in the system. Whenever a processor is available and the queue is not empty, the processor will be scheduled with a new task. The scheduling policies such as First Come First Serve (FCFS) and Shortest Job First (SJF) can be easily implemented. It seems as if this approach may yield good processor utilization. This approach does not provide any mean to schedule fine-grained interacting tasks to run at the same time. Consider the following scenario: Task A already scheduled for a processor but it must wait for completion of Task B which is still in the queue. Even though Task A keeps the processor busy, all it does is to wait. This approach also has potential high communication, memory access cost because this global queue occupies a region of memory that can be accessed by all the processor simultaneously.SJF (SHORTEST JOB FIRST)algorithm associate CPU burst length with each process. When the CPU is available it is assigned to the process that has smallest CPU burst.if two processes have the same length next CPU burst ,FCFS scheduling is used to break the tie.

V. COOPERATIVE CACHING IN WSN

A. Caching process

Cluster cooperative caching is that for a sensor node all other nodes within its cluster domain form a cooperative cache system for the sensor node since local caches of the nodes virtually form a cumulative cache. In each cluster, the cluster head (CH) is selected to act as the Cache Index Node (CIN), which is responsible for recording the information about cached items by all the nodes within its cluster. When a node in any cluster stores some data item into its cache, it sends the information to its CIN so that the corresponding index value can be updated. For each cached item its Time to Live information is also maintained at the CIN. Whenever, cluster head is rotated ,the responsibility of CIN is transferred to new CH. when a node experiences cache miss called local cache miss, the node will look up the required data item from the cluster members by sending a request to the CIN. Only when the node cannot find the data item in the cluster members caches called cluster cache miss, it will request the data from the CIN that lies on the routing path towards source. If a cluster along the path to the source has the requested data called remote cache hit, then it can serve the request without forwarding it further towards the source. Otherwise, the request will be satisfied by the source. It uses a cache discovery process to find the node who has cached the requested data item. When a data request is initiated at a node, it first looks for the data item in its own cache. If there is a local cache miss, the node confirms with the CIN if the data item is cached in other nodes within its home cluster. In case of a cluster cache miss, the request is forwarded to the next hop node along the routing path. Before forwarding a request, each node along the path searches the item in its local/cluster cache. If the data item is not found on the clusters along the routing path, the request finally reaches the data source and the data source sends back the requested data.

Cluster hit: when the requested data item is stored by a node within the cluster of the requester. The requester sends a request to the CIN and the CIN returns the add address of the node that has cached the data item.

B. Cache prevention of admission of item

When a sensor node receives the requested data or a data item passes through it, a cache admission control is to decide whether it should be stored into the cache of node or not. Inserting a data item into cache might not alwaysbe favourable because incorrect decision can lower probability of cache hits and also makes poor utilization of thelimited storage.

Let S be the network size in terms of hop .we calculate the DSi for node ni at a distance Di from sink. So the distance function DSi :

$$DSi = 1 - Di/S$$

A particular data item is to be cached or not is based upon distance function DSi. If the distance function DSi> threshold then cache the contents otherwise not.

1) Cache replacement policy

A cache replacement policy determines which data item should be deleted from the cache when the cache does not have enough free space to store a new item. Such policies apply a value function to each of the cached items, and select as victims, those items which satisfy some criteria. We have developed utility based cache replacement policy, where data item with the lowest utility is removed from the cache. We use LRU approach. Least Recently Used (LRU) approach that replace the page which has not been used for long time in past. In case, if the cache size is not full then it will insert the object in the cache memory. Least Recently Used page replacement policy is simple and easy to use.

Distance : Distance is measured as number of hops between requesting client and responding client.

VI. PROPOSED WORK

The existing approach works centralized basis. The local source node transmits data to its cluster head then the cluster head transmits data to the base station. The base station transmits the data to the cluster head of the cluster containing the destination. The base station is the center that contains all the information in this approach. In the existing approach if base station fails then no communication can occur. The proposed technique removes this drawback by providing a shared cache memory to the each cluster head. Each node transmitting data to its cluster head updates the cache. As the cache memory is shared so the transmission between one cluster updates the cache memory for each cluster head. The source nodes add address of destination in its packet and transmits data to its cluster head. It updates the cache of each cluster. The cluster head then transmits to cluster head of the cluster containing the destination node. Then the cluster head transmits the data to destination. The whole process can be easily understood by following algorithm:

The N nodes of the network are arranged in k cluster and BS is the base station. Each cluster head has a shared cache memory say C.

1. Select a source say S and destination say D.
2. If S is not a cluster head
3. Transmits data from S to its cluster head
4. Update the C
5. End
6. If D is not a cluster head
7. Then send a hello packet to cluster head
8. Update the C
9. Else
10. Update C with its own entry
11. End
12. Determine Cluster Head of the cluster containing the D using C
13. Average=0;
14. For i=1: k
15. Average=average + distance(cluster(s),cluster(i))
16. End
17. Average=average/k;
18. Curcluster=Sc
19. While distance (curcluster,cluster(d))> average
20. Then transmits to neighbor cluster
21. Update curcluster
22. End
23. Transmit data from curcluster to cluster(D)

The above algorithm uses the distributed approach based on cluster heads to transmit the data. The approach is better than the existing approach as the failure of any particular cluster head doesn't stop the whole communication. The implementation of the proposed algorithm can be done by using the MATLAB .

VII. ANALYSIS AND RESULTS

MATLAB is a high-level language and interactive environment that enables you to perform computationally intensive tasks faster than with traditional programming languages such as C, C++, and Fortran. conclusion that we have reduced the distance by using cooperative cache. The cache management is done by shortest job scheduling and LRU replacement approach. We have derive the results that this approach works better in terms of delay analysis, energy consumption by reducing the distance

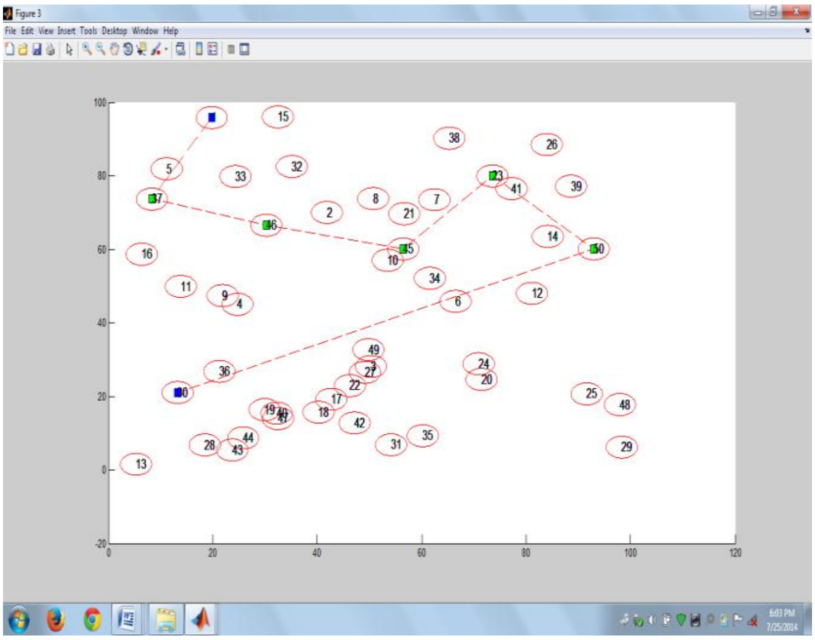

Figure 3: Parameter Analysis by existing work over 50 nodes

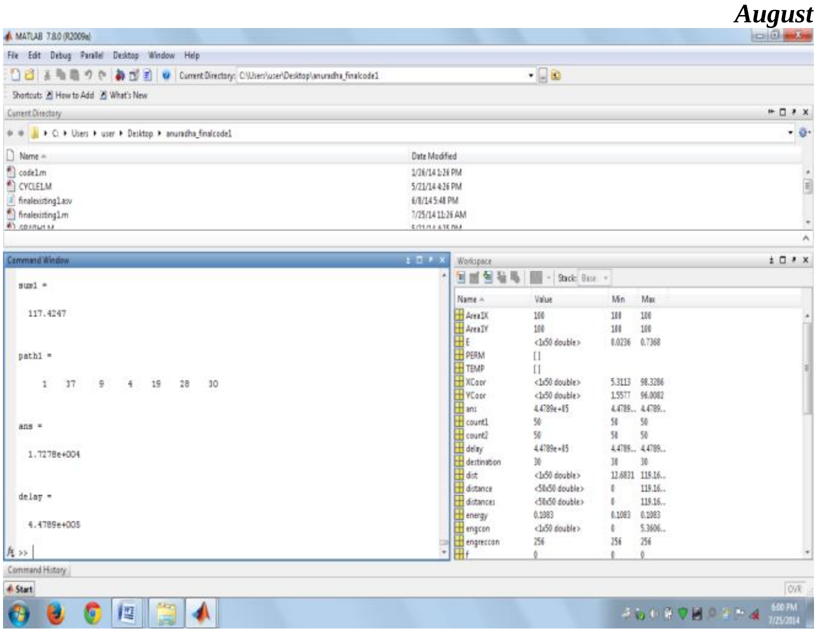

Figure 4: Parameter analysis showing output of existing work.

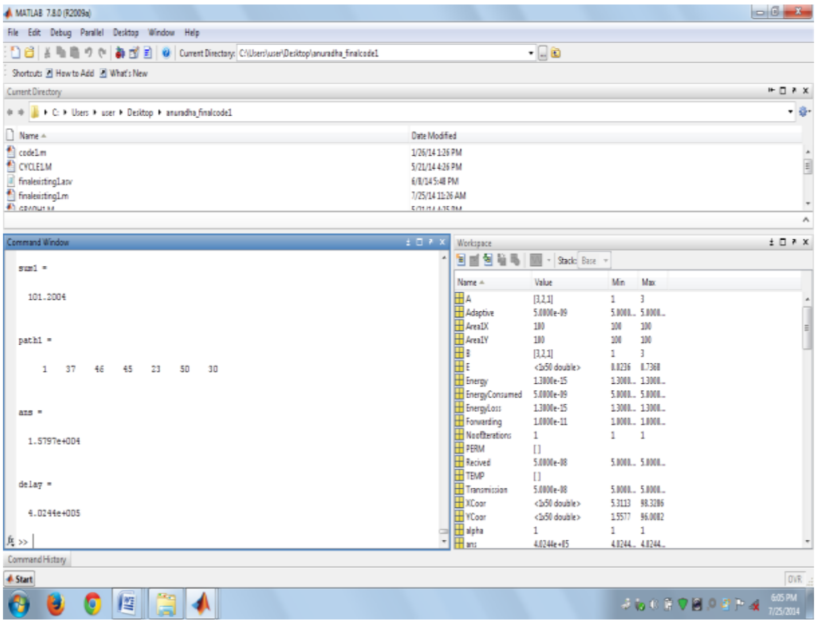

Figure 5: Parameter analysis showing the output of proposed work

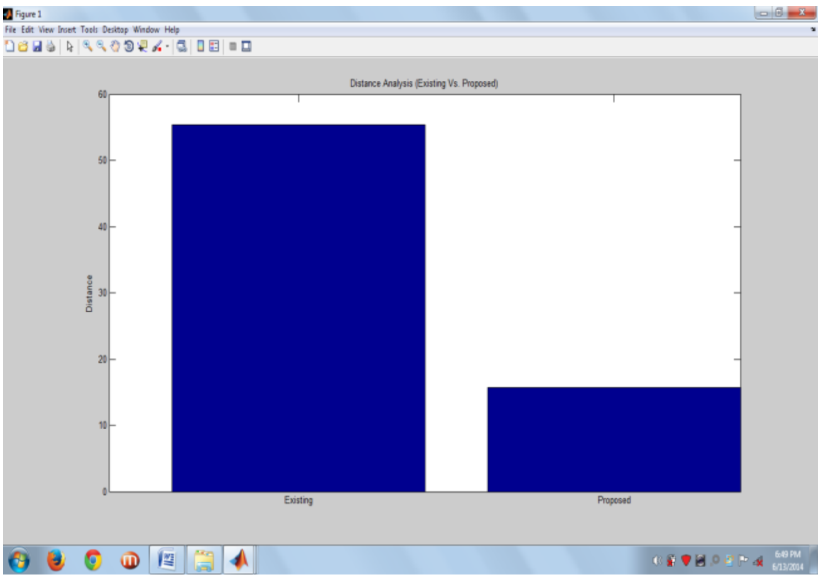

Figure 6:Comparison of distance between existing and proposed work.

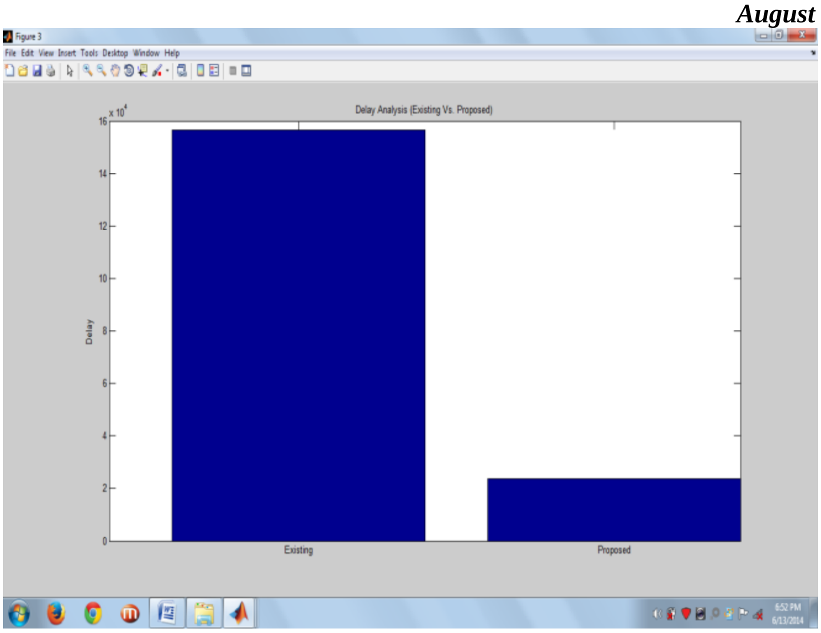

Figure7: Comparison of energy between existing work and proposed work

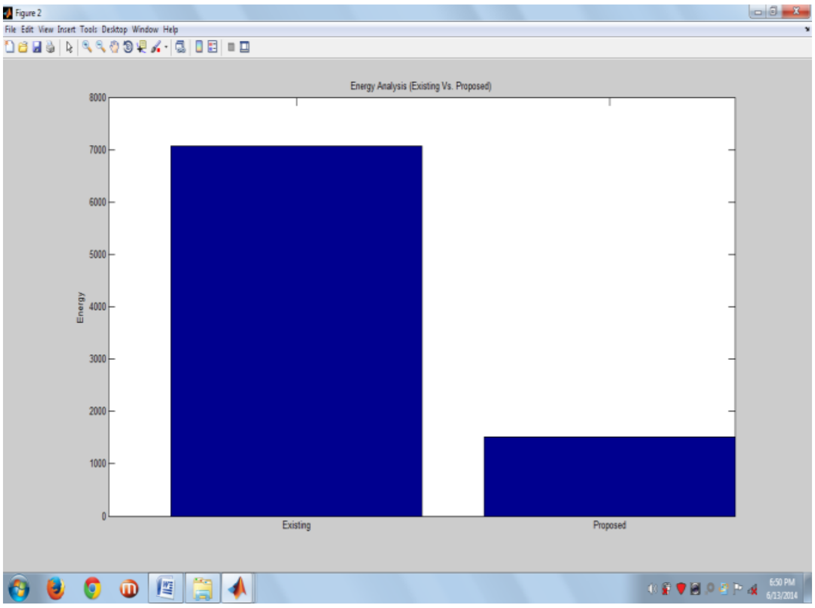

Figure 8: Comparison of delay between existing and proposed work

TABLE 1: PARAMETER ANALYSIS OF EXISTING AND PROPOSED WORK.

Parameter Analysis	**Existing Work**	**Proposed Work**
Distance	117.4247	101.2004
Path Length	1 37 9 4 19 28 30	1 37 46 45 23 50 30
Delay	4.4789e+005	4.0244e+005
Energy	1.7278e+004	1.5797e+004

TABLE 2: PARAMETER ANALYSIS OF EXISTING AND PROPOSED WORK.

Parameter Analysis	**Existing Work**	**Proposed Work**
Distance	55.3831	15.6549
Path Length	1 49 40 43 47 46 45 30	1 24 27 30
Delay	2.5647e+005	1.3612e+004
Energy	7.0682e+003	1.5083e+003

VIII. CONCLUSIONS

By comparing existing work and proposed work , we draw a conclusion that we have reduced the distance by using cooperative cache. The cache management is done by shortest job scheduling and LRU replacement approach. We have derive the results that this approach works better in terms of delay analysis, energy consumption by reducing the distance . The work is about the inclusion of cooperative cache in a sensor network so that most common data values or the message will be maintained in an external memory. The cache is the limited capacity memory with high efficiency. It is available to all nodes over the network. The work is about the maintenance of the cache so that the communication delay is being reduced. The presented approach had improved the effective use of cache for a limited energy network.

In future work the proposed work can be compared with DSR (Dynamic source routing). The proposed work can be extended to use hybrid approach that is centralized as well as distributed approach .The performance of proposed algorithm can be compared with different kinds of cache strategy.

REFERENCES

[1] Fahad R. Dogar, HimabinduPucha ," Ditto - A System for Opportunistic Caching inMulti-hop Wireless Networks",MobiCom’08, international conference on Mobile computing and networking, pp no.-279-290 ,Section – 6.1 , 8 -09 -2008

[2] Ioannis P saras, George Palovu" Probabilistic In-Network Caching for Information-Centric Networks",ICN’12, Information-centric networking,8 August 2012,pp no. -55-60

[3] Sheetal Gupta, Anupam Joshi, “Query Distribution Estimation and Predictive Caching in Mobile Ad Hoc Networks" 13-june-2008.

[4] Jeffrey Erman , Alexandre Gerber, Mohammad T. Hajiaghayi, Dan Pei, Oliver Spats check International World Wide Web Conference Committee(IW3C2). WWW2009,April20–24,2009,Madrid,Spain.4-april-2009.

[5] Naveen Chauhan," A Cooperative Caching Strategy in Mobile Ad Hoc Networks Based on Clusters",ICCCS’11,International Conference on Communication, Computing & Security 1- 02- 2011,pp no.-17 -20.

[6] WeixiongRao,"Optimal Proactive Caching in Peer-to-Peer Network: Analysis and Application",CIKM’07, Conference on information and knowledge managementNovember 6,2007,pp no.- 663-672.

[7] Bo Yang,"Cooperative Caching for k-NN Search in Ad Hoc Networks ",CIKM’05, 2005.

[8] John Ardelius, AkeArvidession ," On the Effects of Caching in Access Aggregation Networks", ICN’12, 4-August -2012.

[9] Roy Friedman," Caching Web Services in Mobile Ad-Hoc Networks: Opportunities and Challenges",POMC’02, 2009

[10] XenofonVasilakos," Proactive Selective Neighbor Caching for Enhancing Mobility Support in Information-Centric Networks",ICN’12,4-August 2012.

[11] ShrutiSanadhya," Asymmetric Caching: Improved Network Deduplication for Mobile Devices",MobiCom’12, 18th annual international conference on Mobile computing and networking, pp no.- 161-172 ,5-August-2012.

[12] PavanNuggehalli," Energy-Efficient Caching Strategies in Ad Hoc Wireless Networks",MobiHoc’03, 4th ACM international symposium on Mobile ad hoc networking & computing ,pp. no.-25-34, 6-June-2003.

[13] F.J. Gonzalez-Canete," Proposal and Evaluation of an Application Level Caching Scheme for Ad Hoc Networks",IWCMC’09, International Conference on Wireless Communications and Mobile Computing, pp. no.- 952-9576- June-2009.

[14] S.A.V.SatyaMurty,PradeepChenkula, T.jayakumar , “Real Time Packet Scheduling for Real Time Wireless Sensor Network”,.2013 3rd IEEE International Advance Computing Conference (IACC),pp no.-273 -276 ,13-feb -2013.

[15] Narottamchand , “ Energy efficient in cooperative caching in wireless sensor network” , World Academy of Science, Engineering and Technology ,Vol:7, 2013-05-28.

[16] Narottamchand , “ Cooperative caching in wireless sensor network”, World Academy of Science, Engineering and Technology,Vol:6 ,2012-03 -27.

[17] Milton Armando , “ On multi path aggregation of duplication sensitive functions”, Milton Armando Cunguara, Toms Antnio Mendes Oliveira e SilvaaoIEETA / University of AveiroAveiro, Portugal, Comput. J., vol. 51, pp. 227–239, March 2010.

[18] Naveen chauhan , “ Effective cache based policies in wireless sensor network”,International Journal of Computer Applications (0975 – 8887)Volume 11– No.10, December 2010

[19] E.kamal , “Routing technique in wireless sensor network”, International Conference on Computer Communications and Networks (ICCCN), pp. 304-309, 2009.

[20] N.dimokas , “ Cache consistency in wireless multimedia sensor network” computer and communication engineering department ,university of Thessaly ,volo, Greece “Ad Hoc Networks” 8 (2010) pp :210-240 .

[21] Rufaida Muhammad Shamroukh, Aryaf Abdullah Aladwan, Ana’am Abdullah Aladwan, (2012) A Novel Approach for Energy Optimization of Wireless Sensors Network by Adaptive Clustering, World of Computer Science and Information Technology Journal (WCSIT) ISSN: 2221-0741 Vol. 2, No. 2, 74-78.

[22] Khan, M. A., Tamim, I., Ahmed, E., &Awal, M. A. (2011). Multiple Parameter Based Clustering (MPC): Prospective Analysis for Effective Clustering in Wireless Sensor Network (WSN) Using K-Means Algorithm. Wireless Sensor Network, 4, 18.

[23] Yun, Y., & Xia, Y. (2010). Maximizing the lifetime of wireless sensor networks with mobile sink in delay-tolerant applications.Mobile Computing, IEEE Transactions on, 9(9), 1308-1318.

[24] Hassanein, H., &Luo, J. (2006, April). Reliable energy aware routing in wireless sensor networks.In Dependability and Security in Sensor Networks and Systems, 2006.DSSNS 2006. Second IEEE Workshop on (pp. 54-64). IEEE.

