INTRODUCTION

Wireless sensor networks (WSN) are one of the best recent significant research areas in this real-time world which are used in variety of applications. For implementing these applications in real-time world, some efficient approaches are used for security reasons on the sensor readings to maximize the network lifetime. In WSNs, there are sensor node devices that are infinitesimal in nature, which carry out limiting sensing and precise monitoring tasks. The current advancements of sensor systems and data processing in wireless communication have endorsed the progress of scattered sensor systems and networks. In WSN there are some routing protocols that should encounter by very special requirements which have dynamic topology and it is in scattered nature. The energy consumption and network’s lifetime extension is the most significant feature of a routing protocol. In recent years, for WSNs, several energy efficient routing protocols have been developed. The energy efficiency is imperative task for sparse distributed sensor nodes in wireless sensor networks in a smart space and tremendous environments. In hierarchical wireless sensor networks, for energy saving mechanism, communication protocol plays a substantial role.

To improvise the lifetimes of nodes and to reduce bandwidth consumption, communication protocol is used as an essential approach. The signal strength which is reduced is transmitted gradually by nodes to find a nearest neighbor for exchange of information. However at fixed initial energy cost, nodes would consume some energy for finding local neighbors, by constructing the chain. For the mobile nodes, several approach of nodes transmission would be examined. If the nodes scrutinize, then the speed and moving of other nodes, then it can be analyzed the measurement of power to reach the other nodes. Possibly, BS can help to coordinate the activities of nodes in data transmission. The minimum hop method is best approach that analyze path for the sink node by forwarding data packets into the nodes which has minimum distance. Representation of distance is by a number of hops. The node which has the minimum distance has the minimum hop count. The one node with maximum energy is considered only when numerous nodes have same distance. The improvement in the average energy consumption in the network is done by Min-Hop and it utilizes the nodes along the shortest paths. This shows increase
in energy gap and decrease in network life time. The improved version of Min-Hop is MAP which is used for lengthening the network lifetime. By selecting the neighbor node, MAP allocates network load with maximum energy. The particular path may comprise one or more nodes with a very low energy. The foremost idea of Path Energy Weight is to map energy level of all nodes along the communication path and to evaluate the energy distribution along the path by providing enhanced weight to a path with secure energy level.

The basic distance vector routing protocols design are proposed by a Periodic ad-hoc network routing protocols for their use in Networks such as mobile wireless ad hoc, including PRNET Jubin et al (1987). ADV Mangione-Smith et al. (1996), WRP Murthy et al. (1996), WIRP Sivalingam et al. (1997). A newly secured ad hoc network routing protocol have been designed and evaluated using distance vector routing protocols. The most efficient and secure ad hoc distance vector routing protocol is strong against numerous attackers producing incorrect routing state in any other node. The design of Destination-sequenced Distance-vector ad hoc network routing protocol (DSDV) Perkins et al. (1994), was mainly used for trusted environments. Sensors which are of inexpensive and having substantial computations are readily available Estrin et al. (1999), Kulik et al. (1999). To gather useful information from the field, a network of sensor nodes are used. To execute a high level function in the network, sensor nodes helps in collecting audio, seismic, and other types of data information. The following parameters are severely constrained by Sensor nodes i.e. the amount of battery power available, lifetime limitation and the network quality. Sensor nodes have to spend as little energy as possible in receiving and transmitting data Mangione-Smith et al. (1996), Sivalingam et al. (1997), Stemm et al. (1996). But these wireless communications consumes significant amounts of battery power. In sensor networks, fusion of data helps to reduce the data transmitted amount over the sensor nodes and the BS. Fusion of data combines one or more data packets to produce a single packet from different sensor measurements in Heinzelman et al. (2000).

### About MAC protocols:

Over the past few years several MAC protocols are being developed for WSNs. They are classified into centralized and decentralized MAC protocols. Most of the centralized protocols operate as a cluster-based scheme. In a cluster-based scheme time slots for each member to create collision free operation within the cluster is done by the base station or cluster header. Therefore, it is essential to have accurate time synchronization protocol in centralized protocols. The next protocol is the decentralized-based MAC protocol. Scheduled and random access schemes are their sub divisions. In the scheduled schemes type, all nodes have to broadcast their wake-up schedule periodically and have to maintain their neighbours’ schedule information. Then the nodes are allowed to transmit data in the midst of active periods of the receivers and according to their own schedules they save energy. Only rough time synchronization is necessary in the scheduled schemes, such as S-MAC, P-MAC, T-MAC and D-MAC.

S-MAC and T-MAC are two renowned and familiar MAC protocols in WSNs. In S-MAC Sivalingam et al. (1997) the energy waste sources are: overhearing, collision, idle listening and control packet overhead. Hence, S-MAC strives on to reduce waste by placing sensor nodes into a periodical sleeping mode at a low and fixed duty cycle. T-MAC Stemm et al. (1997) proves it better than S-MAC in using an adaptive duty cycle. The nodes of sensor will be in sleep mode when there is null activity at time \( TA = (C + R + T) \times 1.5 \), where \( C \) is taken as the length of the contention interval, \( R \) is noted as the length of an RTS packet, and \( T \) is noted as a short time between the end of the RTS packet and at the beginning of the CTS packet. In Figure 1, the basic difference between S-MAC and T-MAC protocols is depicted. T-MAC provides a more desirable option than S-MAC under variable traffic. If the traffic load is heavy, then the throughput of T-MAC performs efficiently than S-MAC. However, packet collisions influence both the S-MAC and T-MAC throughputs. Thus, it is necessity to have an efficient collision avoidance method in order to decrease the waste of sensor nodes battery energy and also to improve the overall network performance.

![Fig. 1: The S-MAC and T-MAC protocols schedules](Existing System)
P-MAC Jubin et al. (1987) is a pattern-based and time-slotted scheduling protocol. Sleep/wake-up schedule based on its own traffic and its patterns of the neighbours is determined by each sensor nodes. D-MAC Murthy et al. (1996) presents a continuous packet forwarding scheme along the data gathering tree in solving the data forwarding interruption problem. ‘A’ node will skew up its wake-up schedule \( dt \) in advance to the schedule of the sink \( (d \) is the depth of the tree and \( t \) is the period noted in sending or receiving a packet).

**Existing Scenarios:**

**Fig. 2: Scenario - I**

In the above scenario there are 4 nodes A, B, C, and D. Nodes A and B so called the neighboring have different schedules. They synchronize with nodes C and D respectively. They are doing synchronization due to their clock drift rates.

**Fig. 3: Scenario – II**

This above scenario explains who could sleep while the node A is transmitting to B?. This means that there is a duration field in each transmitted packet which indicates that how long the remaining transmission will takes place. So if a node receives a packet allocated to another node, it comes to know how long it has to keep silent.

**Fig. 4: Scenario – III [Two-hop network with two sources and with two sinks]**

This is a two-hop network which has two sources and two sinks in it. Packets from source A will flow through node C and ends at sink D, while packets from source B travel through C and ends at E. Thus, the topology is simple and it is sufficient in showing the basic characteristics of the MAC protocols.

**Proposed Approach:**

Figure-5 shows the proposed network communication model with the overall functionality of the adaptive contention slot is given. That means the node 0, 3, 6 are the parent nodes for \{1,2,3\}, \{4,5,6\}, and \{7,8\} child nodes respectively. Now when the parent nodes want to send their data to their child node, they will send directly.
In case of their child node wants to send their data to the parents they have to use their contention slot, time. For example the node 1, 2, 3 is sending the data to its parent 0 means the contention slot of node 1 is first and the next is for node 2 and the next slot for node 3 is sending sequentially without wasting the time and never wait for the other slots. The complete simulation output is simulated in NS2 and it will be explained in brief in the next chapters.

In the ESR-MAC slot reservation process, when there is no traffic in the network, the nodes will wake up at the contention slot to receive a data packet and also for broadcasting the reservation slot schedule at the control slot. In contrary with S-MAC to T-MAC, the protocol we defined is a slotted MAC protocol. It is termed as AMAC. Nodes can efficiently handle their traffic based on the slotted architecture. And with these time slotted architecture, the receiver could able to reserve slots to the senders and able in performing a collision free transmission. Thus, our defined protocol can improve the throughput of the network and also reduce transmission delays without any impact on the conservation of energy. But in this paper we proposed ACSA approach. This technique dynamically adjusts the overall contention slots needed to resolve collisions due to the heavy traffic load, and thus considerably improves the overall system performance. In the proposed ACSA mode, a node can be of two states. The states are defined as Low Contention (LC) and High Contention (HC) state. A node will be in HC state when it receives notification message from its one hop or from its two-hop neighbors. If not it is considered as if it is running in LC state. In this AMAC – so named Adaptive MAC, a node can prevail in HC state for a predefined duration of THC. But if a node does not receive some new notification messages during that period, it will return back to LC state automatically.

While in the LC state, all the nodes are permitted to transmit in any time slot which implies that all nodes runs in CSMA mode. Nevertheless and unlike conventional CSMA, a priority is assigned to each node and needs in computing for a time slot according to its basic priority. Here the person who owns the slot possesses the highest priority against the other nodes. But in specific, a node priority is associated with its Contention Window (CW). If suppose the slot n begins at time t0 and the one who owns the slot is in node A and then the CW for node A was defined as [t0, t1]. While for other competitors the CW is taken as [t1, t2], where t0 < t1 < t2. In the Fig. 2 it shows the slot competition mechanism by priorities. Such channel utilization is improved by the dual-state operation in significant manner. Within a given time slot, if the owner state is HC then the two-hop neighbors are not allowed to maintain at the same slot. By the way of explanation, only the owner and its one-hop neighbors can contest for the slot access. Therefore, the hidden terminal problem causes collisions can be considerably reduced. Similarly, each node is assigned with a priority in the state of HC and the competition of the slot will follow the same strategy schedule as that of LC state.

In accord to that, the sender will control the appropriate period to switch its operation mode. But if a node experiences high collision rate, then the packet loss rate will be increasing in the same manner. As A-MAC does not use RTS/CTS mechanism in order to avoid collisions, current contention level is in proportion with the collision rate. Therefore, the level of contention was estimated by counting the lost ACKs number. Similarly when a node misses Nth ACKs (Mode switch threshold), then notification message is sent to all of its two-hop neighbors which inform them not to act as hidden terminals so that the collisions could be avoided. By the way, the node switches to the HC state.
RESULTS AND DISCUSSIONS

The adaptive contention slot allocation mechanism is simulated in Network Simulator software for analyzing the performance in terms of number of slots successfully transmitted, time taken and especially in terms of energy. For the simulation, the number of nodes is increased from 20 to 100 numbers of nodes and repeated the process. According to the number of nodes the various parameters are calculated and the performance is verified. In each round certain number of slots is allocated for each node and the slots should be transmitted within a time schedule. For example 20 slots are allocated for 10 nodes where each node should transmit the slots within a time interval. Fig.7 shows the number of slots transmitted successfully. For 20, 40 and 60 number of nodes the allocated slots are transmitted successfully. But for 80 and 100 number of nodes some slots are not transmitted successfully.

![Successful Slots Transmitted](image)

**Fig. 7:** Successful Slots Transmitted.

![Time Taken for Successful Slots Transmission](image)

**Fig. 8:** Time Taken for Successful Slots Transmission.
If the first slot transmitted within the time interval then the next slot follows the first slot and there will not be a collision. If all the slots transmitted from the source node within the time interval then the delay taken for slot allocation is also less and it saves more energy in the network. Due to this the network life time gets increased. Figure-8 shows the delay taken by our proposed approach, which is more or less equal to the allocated time. Figure-9 shows the energy taken to transmit the slots is very less for the slots allocated to the nodes in the network.

**Conclusion:**
In this paper we have studied issues pertaining to computation and communication in heterogeneous parallel systems. Current high-speed networks cannot fully satisfy the high-bandwidth and low latency requirements of heterogeneous systems because they employ electronic network protocols. Developments in the area of optical networking, especially passive star-coupled optical interconnection, promise to meet the bandwidth and latency demands of heterogeneous systems. In this paper, we considered medium access strategy, contention resolution protocols and communication topology in an integrated manner. We developed have different communication topology protocol combinations to work with passive star-coupled optical interconnection. All these topology protocol combinations were evaluated for heterogeneous parallel systems with commonly used master-slave computation model. It was observed that three topology protocol combinations are capable of significantly reducing channel contention and delivering the best performance. These combinations are hierarchical interconnection with ALOHA protocol, direct communication with TDMA protocol and direct communication with tunable optical filters at the nodes. However, the TDMA protocol was found to be suitable for only a limited set of applications. The remaining two combinations were observed to deliver comparable performance for a wide range of applications. Therefore, the proposed hierarchical interconnection on a passive star-coupled optical network with ALOHA protocol is most suitable for heterogeneous parallel systems. The analysis and results presented in this paper provide guidelines for building large-scale heterogeneous systems to deliver high performance while minimizing communication overheads and channel contention. The simulation results lead us to believe that when the hierarchical interconnection is combined with the tunable optical filter.

**REFERENCES**


References should be cited in the text as: Hafez, Tajik and Nazifi, Bai, (2011-2012). The list of references at the end of manuscript must be arranged alphabetically and each reference in the list should appear in the following form.


