Wireless Sensor Networks on Time Synchronization: A Survey

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Abstract- Wireless sensor nodes are consist of small electronic devices which are experienced of sensing, computing and transmitting data from the physical environment. Wireless sensor networks are limited in energy resources, storage capacity and bandwidth, traditional time synchronization algorithms like Network Time Protocol (NTP) and Global positioning system (GPS). Time Division Multiple Access scheme to improve the convergence time and to achieve energy efficiency. This paper explains the time synchronization problem in wireless sensor networks and details the basic algorithms proposed in this area.

I. INTRODUCTION

Wireless Sensor Network is a collection of large number of sensor nodes. WSN [1] is basically an emerging area in which a number of sensor nodes used to deploy to perform data gathering tasks. A network that consists of large number of devices that are distributed, self-directed as well as small in size is known as wireless sensor network. These small devices present within the WSN are known as sensor nodes. Wireless is a mobile communication. Wireless sensor network consist of group sensor node to perform distributed sensing task using wireless medium. WSN exist of a base

- Communicating
- this information wirelessly with this neighbor.
- A sensor network is a wireless network that consists of thousands of very small nodes called sensors.
- They are organized in a cooperative networks.
- They communicate wirelessly in multi-hop.

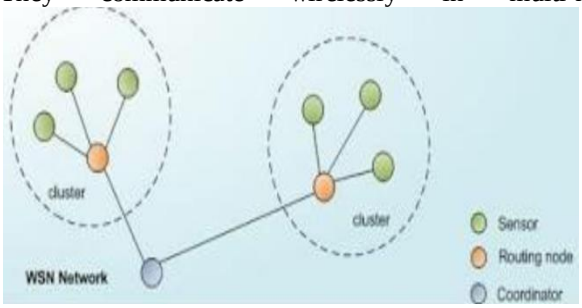

Fig.1: Wireless sensor networks

stations and a number of wireless sensor nodes. The network without a fixed well defined infrastructure that is consist of a collective networked sensor nodes and nodes are designed to intercommunicate like a wireless radio.

Wireless sensor networks (WSN) is sometimes known as wireless sensor and actuator networks (WSAN).

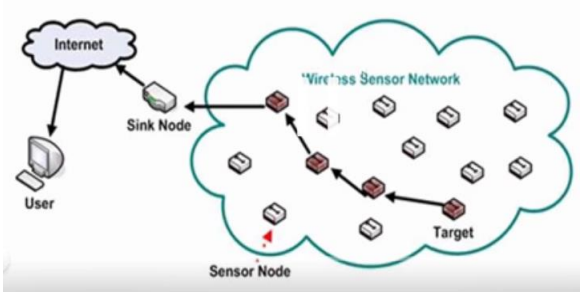

Fig.2: Structure of a WSN

- Interacting with their environment through various sensors

II. CHALLENGES IN WSN

"Challenges in such a WSN includes the giant bandwidth demand, more energy utilization, quality of service (QOS) belongings, data processing, the compressing techniques and cross-layer design. Mobile nodes have the ability to sense, compute and communicate like static nodes." The sensor networks have a many technical challenges due to some factors as given:

- Energy efficiency
- Low bandwidth and high error rates
- Errors are common
- Wireless communication
- Noisy measurements
- Node failure are expected
- Flexibility to the huge number of sensor nodes
- Security issues
- Synchronization and localization

III. ENERGY CONSUMPTION PROTOCOLS

A. LEACH

LEACH [2] stands for Low-energy adaptive clustering hierarchy (LEACH) is one of the most popular hierarchical routing algorithms for sensor networks. The function of the cluster head in LEACH protocols is the collection and combination of data received from a member sensor nodes and forwarded the information directly to the base station. It uses two-tier hierarchy clustering architecture. It can be used for the distributed algorithm to organize the sensor nodes into the clusters. The cluster-head nodes create TDMA schedules. Nodes transmit data during their assigned slots. The energy efficiency of the LEACH is mainly due to data fusion.

The main objectives of LEACH are:

- Extension of the network lifetime.
- Reduced energy consumption.
- Use of data aggregation to reduce the number of communication messages.

The operations that are carried out in the LEACH protocol are divided into two stages:

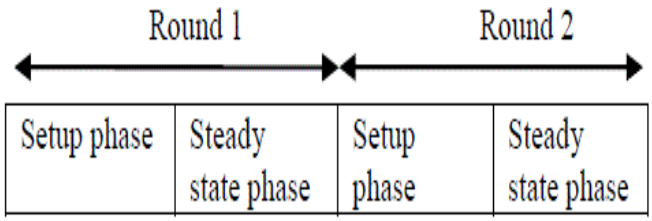

Fig.3: LEACH Phases: Setup and Steady Phase

I. The Set-up phase :
- When cluster heads are chosen.
- None cluster head get involved.

II. The Steady-state phase :
- The cluster head is maintained.
- When data is transmitted between nodes.

B. RFID

The RFID [3] is abbreviated for Radio Frequency Identification. Radio supported for invocation of a wireless transmission and the propagation of data or information. The RFID is self organized technology which is based on the radio frequency. In RFID there are three modes:-

1. Sleep Mode: In Sleep Mode, Data is neither in the form of sensing nor a Transmission.

2. Active Mode: In Active Mode, Data in the form of Sensing but not in Transmission.

3. Ready Mode: In Ready Mode, either the Data is in the form of sensing or Transmission. That the Sleep, Active and Ready modes do not work efficiently due to non-synchronization.

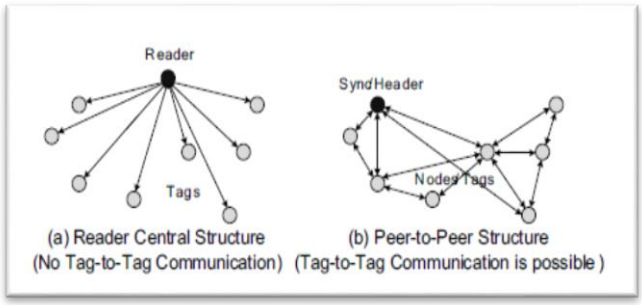

Fig.4: Communication structure of a RFID

RFID Tag [4] (Attached with an object and possess unique identification) • RFID Reader [5] (Manipulator and receiver of RFID Tag information.

C. TDMA

TDMA [6] is a Time-Division Multiple Access. A channel access method that is involved within the shared-medium networks is known as the (TDMA). Similar frequency channel divides the signal into various time slots which can further be utilized by multiple users at similar time duration. This results in rapid transmission of data in continuous manner in which every user uses its own particular time slot. TDMA is a Digital Multiplexing technique for combining several low rate channels into one high-rate one. In TDMA, there is requirement of Synchronization. TDMA circuitry is not very complex. In TDMA, Duration is inversely proportional to the Travel. If there is a decrease in a duration that means travel increases and vice-versa.

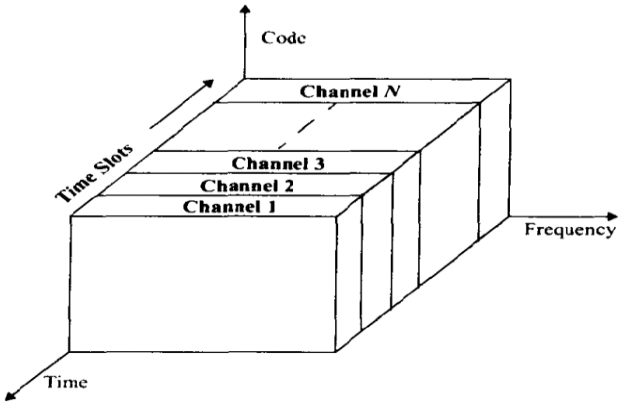

Fig.5: TDMA

In this figure 5 it explains that:
- TDMA systems divide the radio spectrum into time slots.
- A set of 'N' slots form a frame.
- TDMA systems transmit data in a buffer and burst method.

IV. SYNCHRONIZATION ISSUES

A. TPSN

TPSN [7] is Timing-sync Protocol for Sensor Networks. TPSN is a typical Protocol of the offset-only class. The TPSN algorithm includes two phases, first it creates spanning tree of the network and then performs pair wise synchronizations along the edges.

B. RBS

RBS [8] is a Reference Broadcast Synchronization. In a RBS, the reference message is broadcasted. The receivers record the local time when this receives the reference message and exchange the recorded times with each other and its determine a offset between nodes.

C. FTSP

FTSP [9] is Flooding Time synchronization Protocol. FTSP is proposed in which receivers are synchronized with a sender by sender broadcasting a single radio message time-stamped at both the sender and the receiver sides.

V. LITERATURE REVIEW

Ahmad Razani Haron, et.al (2013), "Energy Consumption and Lifetime Analysis for Heterogeneous Wireless Sensor Network" The [10] author proposed a new technique which is used to elaborate the results from the simulation. The technique proposed by author is used for energy efficient routing protocol for hetrogeneous WSN and compare LEACH, the EEHC and EECDA which resulted in a significant increase in network lifetime.

Tifenn Rault, et.al, (2014), have recommended that the design of sustainable wireless sensor networks (WSN) is a very challenging issue. It is expected that energy constraint sensors should run for a long period of time. The [11] authors have work on proposing the energy saving problem in WSNs. Finally they analysed the techniques which are applied in WSNs to reach the trade-off between the multiple needs, such as multi-objective optimization.

Ton Van Deursen, et.al, (2008), "A case study on security of RFID protocols", The author [12] investigate the security claims of proposed strong security RFID authentication protocol. The author observed from previous communication between a tag and the reader.

Qian Liao et.al, (2013) have proposed an energy balanced clustering algorithm based on LEACH protocol' This paper analyses the effectiveness of LEACH protocol in cluster-heads selection, and proposes and improved clustering algorithm. Simulation solution shows that enhances of a protocol which is better than the LEACH in assessing a node for energy consumption. To improve the efficiency of data transmission and prolonging a network life.

Fuhuo Lin, et.al, (2016), have proposed an Enhanced Fast Converging and Energy-Efficient Flooding Time Synchronization Protocol(EFTSP) based on storing and forwarding synchronization messages uses TDMA scheme to improve the convergence time and to achieve energy-efficiency. The SEFTSP protocol has shorter synchronization convergence time than FTSP and uses less energy than other time sync protocols based on CSMA/CA.

VI. PROPOSED WORK

1. To propose improvement in Time synchronization protocol for clock synchronization in wireless sensor networks.
2. The proposed improvement will be based on time lay technique for the clock synchronization in WSN.

VII. CONCLUSION

The RFID is the protocol which is applied and it leads to apply transmission modes in the network. There are three transmission modes in the network and these are active, sleep and ready mode. The node which is neither sense data nor transmits data is in the sleep mode. The node which sense data and do not transmit data is in the active mode. The node which sense data and also transmit data is in the ready mode. The clocks in the network are weekly synchronized due to which the modes are not able to work efficiently which increase packetloss and energy consumption. In this work, the novel technique is been proposed which synchronize the clocks of the sensor nodes. The proposed technique is based in the MAC time for the clock synchronization in the network.

VIII. REFERENCES

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