Abstract:

In recent days, processing multimedia data plays a major role in all fields especially in wireless sensor network. Transferring multimedia data across the wireless sensor network is a big challenge. Routing the multimedia data in many paths is a good choice to transfer them in an efficient manner. In this paper, we focused on the network model of WSN, various aspects in design of WSN for multimedia data and standard protocol such as SPEED, MMSPEED and EAQoS are surveyed.

1. Introduction

In the last few years, processing multimedia data in Wireless Sensor Networks (WSNs) has become a promising technology. Generally, wireless sensor network has set of sensor nodes that are powered by small irreplaceable batteries. These sensor nodes are smartly positioned in the area to be monitored. It will sense the environmental behaviors and transmit data towards the base station or the sink node. A WSN consist of both data sensor and video sensor. Both can be used in variety of applications such as tracking, home automation, environmental monitoring, Traffic monitoring system, batter field, etc. The data sensors sense motion, sound, heat, or light to initially identify and locate the target. The video sensors can be triggered by the data sensors to provide video of the target or it can operate independently to sense and transmit video of the environment. Due to the restricted communication range and high density of sensor nodes, packet forwarding in sensor network is usually performed through multi-hop data transmission. Therefore, routing in WSN has been considered an important field of research over the past decade. Resource limitations of the sensor node and unreliability of low-power wireless links, in combination with various performance demands of different applications impose many challenges in designing efficient communication protocols for WSN. Meanwhile, designing suitable routing protocols to fulfill different performance demands of various applications is considered as an important issue in WSN. The sensor nodes perform desired measurements, process the measured data and transmit it to a base station, commonly referred to as the sink node, over a wireless channel. The base stations collect data from all the nodes and analyze those data to draw conclusions about the activity. Sink which is a powerful data processor or access point for human interface can also act as gateway to other networks. WSN have restrictions in supporting the video/audio streaming applications because of the lack of raw bandwidth, poor link characteristics and limited power supply. Multimedia data processing in WSN has become promising technology. The data sensor node finds and locates the target in order to sense the motion, sound, heat and light. On the other hand, it triggers the video sensor nodes in order to transmit the video. When multiple paths are being used concurrently, the broadcast nature of wireless channels result in inter-path interference which significantly degrades end-to-end throughput. Recently, various routing protocols have been proposed for WSNs. Most of them use a single path [4] to transmit data. The optimal path is selected based on the metrics, such as the gradient of information, distance to the destination or the node residual energy level. Various other routing protocols [5] [6] which use multiple path will choose the network reliability as their design priority. The objective of this paper is to analyze the various aspects in the design of wireless sensor network and study the existing method for multipath routing in wireless sensor network for multimedia data. This paper is organized as in section 2 various aspects in the design of WSN for multimedia data are discussed. In section 3 we propose a network model for wireless sensor network. In section 4, 5 & 6 discusses about the existing mechanism for handling multimedia data in wireless sensor network. Finally the conclusion is given in section 7.

2. Aspects in the design of WSN for multimedia data:

There are several aspects that mainly influence the design of a WSN especially for multimedia data, which are summarized in this section.

- Power consumption. It is one of the basic aspects in wireless sensor network. Sensor nodes are battery-constrained devices, multimedia applications intended to generate large amount of data. Hence, require high transmission rates and extensive processing.
- Application-based QoS requirements.

Generally the sensor nodes are provided with data delivery mode in addition to that, some node may be available with multimedia data which
includes photograph and streaming multimedia content. Photograph based multimedia data will be triggered whenever the event is occurred in a particular period of time. Streaming multimedia content is generated over longer time periods and requires data delivery frequently. Thus, a powerful sensor node is required in terms of hardware and supporting high-level algorithms to deliver QoS and consider application-based requirements. These requirements may be uttered in terms of power consumption, jitter, reliability, distortion or resource utilization, throughput and network lifetime.

- **High bandwidth.** In order to transfer Multimedia data especially for video streams, we require high bandwidth. Hence we can avoid data loss and delay to reach the sink node. Data rates at least one order of magnitude higher may be required for high-end multimedia sensors, with comparable power consumption. Hence, high data rate and low-power consumption transmission techniques need to be controlled.

- **Multimedia source coding techniques.** Some coding techniques are required to handle the multimedia data since sending multimedia content as such requires high data rate. The compressed data or convert multimedia data into text form is preferred instead of sending the multimedia content.

- **Flexible architecture to support heterogeneous applications.** When we about to design architecture it is compulsory to develop flexible, hierarchical architectures that can accommodate the requirements of all kind of applications in the same infrastructure. Usually WSN architectures will support several heterogeneous and independent applications with different requirements.

- **Multimedia coverage.** Video sensors can capture images only when there is unobstructed line of sight between the event and the sensor. Hence, coverage models developed for traditional wireless sensor networks are not sufficient for multimedia sensor network. It is very important to deploy the sensor nodes with high coverage range.

### 3. Network model

Designing scalable network architecture is the most important characteristics to be considered. Many of the proposals for wireless sensor networks are based on a flat, homogenous architecture in which every sensor has the same physical capabilities and can only interact with neighboring sensors.

![Network Model for wireless Sensor Network](image)

Conventionally, the study on algorithms and protocols for sensor networks has focused on scalability, i.e., how to design solutions whose applicability would not be limited by the growing size of the network. Flat topologies may not always be suited to handle the amount of traffic generated by multimedia applications including audio and video. Likewise, the processing power required for data processing and communications, and the power required to operate it, may not be available on each node. Fig 1, we introduce a network model for Wireless Sensor Network for multimedia data, where two sensor networks with different characteristics are shown, probably deployed in different physical locations. The first cloud on the left shows a single tier network of homogeneous video sensors. The multimedia content gathered and is transferred to the base station/sink node by means of multipath routing. Another cloud on the right shows the single tier network of heterogeneous sensor network which consist of both video sensor node and data sensor node. The video sensor node is to capture the motion picture and send it to the nearby data sensor node and the data sensor node will forward the multimedia data by means of multipath routing.

### 4. SPEED: A Stateless Protocol for Real-Time Communication in Sensor Networks [17]:

In this paper, they have proposed a real-time communication protocol for sensor networks, called SPEED. The protocol provides three types of
real-time communication services, namely, real-time unicast, real-time area-multicast and real-time area-anycast. The design of the SPEED protocol is stirred by the observation that not like wired networks, where the delay is independent of the physical distance between the source and destination, in multi-hop wireless sensor networks, the end-to-end delay depends on not only single hop delay, but also on the distance a packet travels. The objective of the SPEED algorithm is to support a soft real-time communication service with a desired delivery speed across the sensor network, so that end-to-end delay is proportional to the distance between the source and destination. SPEED maintains a desired delivery speed across sensor networks by both diverting traffic at the networking layer and locally regulating packets sent to the MAC layer. It consists of various components which includes a neighbor beacon exchange scheme, delay estimation scheme, Stateless Non-deterministic Geographic Forwarding algorithm (SNGF), Neighborhood Feedback Loop (NFL), Backpressure Rerouting, Last mile processing. Routing operations are processed by SNGF routing module. NFL and Backpressure Rerouting are used for congestion control. The last mile process is given in order to support three communication semantics namely real-time unicast, real-time area-multicast and real-time area-anycast. SPEED preserves a preferred delivery speed across the wireless sensor network through a combination of feedback control and non-deterministic QoS-aware geographic forwarding. This combination of MAC and network layer improves the end-to-end delay and gives premium response to congestion and voids.


In this paper, they have proposed a packet delivery mechanism called Multi-path and Multi-Speed Routing Protocol (MMSPEED) for probabilistic QoS guarantee in wireless sensor networks. The QoS condition is evaluated in two qualities namely, timeliness and reliability. Multiple QoS levels are provided in the timeliness domain by guaranteeing multiple packet delivery speed options. In the reliability domain, various reliability requirements are supported by probabilistic multipath forwarding. The main objective of this paper is global network state should not be affected by localized packet routing and there is no need for priori path setup for the local packet routing. This can be achieved by employing localized geographic packet forwarding augmented with dynamic compensation, which compensates the local decision inaccuracy as a packet travels towards its destination. The second objective is to provide a different QoS options in isolated timeliness and reliability domains. MMSPEED can assure end-to-end requirements in a localized way, which is desirable for scalability and adaptability to large scale dynamic sensor networks. A major extension over SPEED, the MMSPEED protocol can able to distinguish between flows with different delay and reliability requirements. MMSPEED provide choice over reliability and timeliness of packet arrival. Hence MMSPEED is based on a cross-layer approach. It is argued that the differentiation in reliability is an effective way of channeling resources from flows with relaxed requirements to flows with tighter requirements. Importantly, a new metric called On-Time Reachability is introduced which is a measure of the probability that a packet reaches its destination within required delay bounds. While current research directions make an effort to provide real-time streaming, they are still best effort services. Giving firm delay guarantees in a dynamically changing network is a difficult problem and yet is important for seamless viewing of the multimedia frames.


Multimedia data transmission requires both energy and QoS aware routing to guarantee the efficient usage of the sensors and effective access to the gathered measurements. In this paper they have proposed an energy-aware QoS routing protocol for wireless sensor networks which can also run efficiently with best-effort traffic. Their approach is based on a cost function for each link. K least cost path algorithm is used to find of candidate routes and theses route are checked against the end-to-end QoS parameter whichever link provides the maximum throughputs will be selected. Class-based Queuing model is used to classify real-time and non-real-time traffic in each sensor node. The protocol finds QoS paths for real-time data with certain end-to-end delay requirements. The comparison of SPEED, MMSPEED and EQoS is tabulated in Table 1.
Table 1 Comparisons of different Approach

<table>
<thead>
<tr>
<th>Method</th>
<th>Approach Used</th>
<th>demerits</th>
<th>Metrics considered</th>
<th>Type of data transferred</th>
<th>Simulation Environment</th>
<th>Number of nodes considered</th>
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<tr>
<td>SPEED</td>
<td>• Void avoidance</td>
<td>Priority and delivery guarantees, and a packet’s speed cannot be increased</td>
<td>End-to-End delay, Energy, Data Delivery Ratio</td>
<td>Real time data</td>
<td>GlomoSim</td>
<td>100 Nodes</td>
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<td></td>
<td>• Back-pressure re-routing</td>
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<td></td>
<td>• Last Mile Process</td>
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<td></td>
<td>Supports multi-path forwarding</td>
<td>Does not handle network layer aggregation, energy-delay trade-off</td>
<td>Reliability, Timeliness</td>
<td>Real time data</td>
<td>J–Sim</td>
<td>100 nodes</td>
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<tr>
<td>MMSPEED</td>
<td>dynamic recompense and increase the packet delivery speeds</td>
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<td>EAQoS</td>
<td>Queuing model for real time and non real time traffic in WSN</td>
<td>Only single request is handled Multiple priorities not supported multi-path calculations require complete knowledge about topology</td>
<td>end-to-end delay, buffer size, packet drop probability</td>
<td>Real time data, Non real time data</td>
<td>-</td>
<td>100 nodes</td>
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<td></td>
<td>K least path algorithm</td>
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**Conclusion:**
This survey has explored multimedia streaming in wireless sensor networks. We have precised the requirements of the multimedia streaming traffic that need to be met by the network layer. We have surveyed the schemes proposed for handling multimedia data and how it should be routed across the network in order to reach the base station/ sink node. The features of SPEED, MMSPEED and EAQoS were compared. Our future work is to design an efficient routing algorithm for transferring multimedia data in wireless sensor network.

**References**


