Transmitting urgent data using ANKM method.

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Abstract:

WSN contains lots of sensors which are used to form a network. There are different types of applications like object tracking, habitat monitoring, precision agriculture, building monitoring and military systems generate lots of urgent data. so the data must have to send successfully. This successful transfer of data or packet increases performance of the system. The protocol which is in Transport layer, can't directly provide this facility for that we propose one mechanism called "PAT" which stands for "Path Assured Data Transfer" which is used for fast transmission of data,and also used for accuracy in data sending without packet loss.

Keywords:
WSN, Congestion, Control Protocols, Reliability Protocols, Buffer Occupancy, Rate Adjustment.

A) Introduction

A WSN is used for fast and reliable transfer of urgent information to establish network infrastructure which will help to make our society safe, secure, comfortable. If there is network congestion then some packets will be not reach to the destination due to small size of the buffer. These will results in data loss, decrease in throughput, and loss of energy. For this reason, congestion control is a critical challenge in WSN. A WSN carry both urgent data and normal information which can't handle both. It means that WSN must be capable sending packet by deciding weather they are urgent or not.WSN also provide a packets with higher priority are transmitted. In WSN it is important that operation of sensor network should be energy efficient, which shows lifetime of network. this mechanism eliminate possible delay and loss of packets because of collision and wireless transmission. Also this paper explores the design decision related to sensor network for providing reliable data transport. Fig1 shows basic diagram of WSN.

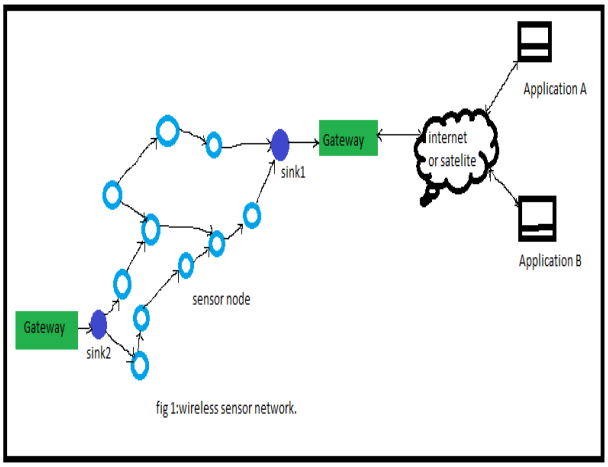

fig 1:wireless sensor network.

Organization of the paper

Paper is organized as follows: Section A present different transport layer protocol. Different approaches and design issues of existing transport layer for reliability, congestion detection, and congestion elimination are also discussed in section B literature survey. Section C describes the problem definition and goal. Design and implementation of ANKM mechanism describe in section D. Finally, we conclude given approach in section E.

B) Literature survey

Most of WSN applications require delivery or transmission of data and packet in reliable manner. Due to features of WSN, designing a reliability in data transfer protocol has many challenges, such as energy consumption, more sensor node, data-centric networking, and small size of message. In this Section, it contain overviews and survey of transport protocols which has the property of reliability in transfer of data, congestion control & congestion elimination in WSN. In wsn there are many transferring protocols are designed. Some of the transport protocols are listed and encapsulate in Table 1.correlation in between congestion aware and reliability of different protocols that are displayed in the transport layer is in table 2.

Transport protocols for reliability and congestion control

Table 1 consist of reliability protocols that are obtain. Parameters that are shown in the table are DCC, CCC and No Congestion Control [NCC]. A few protocols has reliability and others has unreliability. The protocols that are reliable are Flush, STCP- Support DCC; RCRT is CCC; and Wisden, Telnet, RMST have no congestion control. The protocols that are Unreliable are IFRC, Fusion, CODA which support DCC; QCRA, ESRT are CCC; Cent Route, RBC, surge have no congestion.

Table 1. Reliability of existing transport protocols

	DCc	CCC	NCC
Reliability	Flush, STCP	RCRT	Wisden, Telnet, RMST
Unreliability	IFRC, Fusion, CODA	QCRA,ESRT	Surge, CentRoute, RBC

DCc-Distributed Congestion Control
CCC-Centralized Congestion Control
NCC- No Congestion Control

Transport Layer Characteristics are as follows:
different protocols in WSN at transport layer support:

Reliability: loss of packet in wsn is due to Congestion occurring in WSN; because of that packet reliability is required. every protocol in transport layer for WSN offers unidirectional packet delivery and also the reliability in message transmission, but in certain application reliability is necessary. Property of reliability in WSN categorized as packet reliability, H-H reliability,E-T-E reliability, UPreliability and Down reliability.

Related work:

a) Protocols which has a property of reliability

1) ERTP(Energy efficient Transport protocol): Data streaming application is used by this protocol. It is also has a packet reliability. In data streaming application here the way which is used is sensor monitoring are same to sink through sensor nodes. Energy dissipations id reduced by using E-to-E approach. It controls maximum number of retransmions dynamically at each sensor nodes. It uses stop-and-wait hop-by-hop impact acknowledgement for recovery. The acknowledgement for the transmitted is send by sink node to source node for every signal and if the acknowledgement is not received the same packet is again sent. [1]

2) ESRT (Event to Sink Reliable Transport): It Provides upstream event reliability and congestion control and it avoid the dropping of packets and minimum energy consumption. ESRT uses an end-to-end access to recognize a desired reliability figure over modify the sensor's reporting frequency. It provides overall reliability for the application. Benefit of ESRT is energy conservation through control of reporting frequency. [2]

3) PSFQ (Pump Slowly Fetch Quickly):
This protocol specially used for unicast communication. This protocol has three objective like message transferring, Discreminatory status reporting and relay originated error recovery. It is downstream protocol. That's why it handle and control reliability in reverse direction.[3]

4) GARUDA: It is downstream protocol used for reliability from sink to source. It operates two stage Mac recovery. Wait-for-first-packet pulse is used for generating initial packet delivery. initial packet delivery introduce core infrastructure. By using first packet delivery number of hop from sink to node is determined. The nodes which come under the path of hope count become the core member. It uses out-order strategy for overcoming under utilization scenario.[4]

5) RBC:
RBC stands for Reliable Bursty Convergecast protocol.
It uses windowless block acknowledgement scheme which copies the acknowledgement to forward the data packet continuously. A sensor node having large memory uses the RBC protocol, because it require large memory. Data packets are transmitted for few numbers of times. [5]

6) DTC (Distributed TCP Caching):
This protocol is fully compatible with TCP. And it is also an modified version of TCP. it uses the AIMD algorithm for transmission window and H-T-H loss recovery scheme [6]

b) Congestion detection:
for detection of congestion various parameters are used by different protocols. Node delay is the delay which is expected at every node by each packet. Channel Status

[CS]. Information about how busy the channel is, and the interference of surroundings is provided by the CS, which detect whether the channel is ready to receive and transmit data without congestion.
Congestion notification is also a essential factor, the notification data about the congestion urgency to transmit from the congested nodes to neighbors or to the source nodes in wsn after recognize congestion.

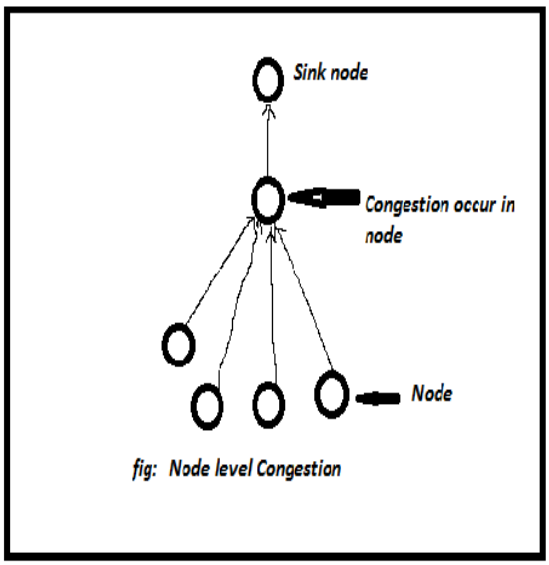

Fig (2) Node level congestion

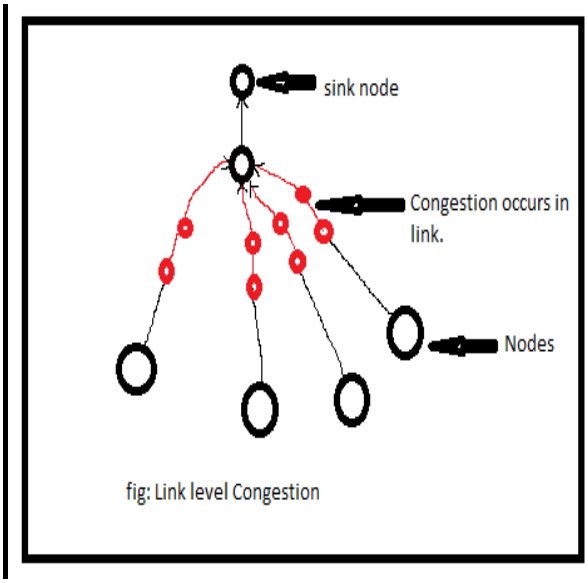

Fig (3) Link level congestion

Protocols for Congestion Control:

1) Fusion:
a bit called CN (Cn stants for congestion notification) is set by congestion node in a first field that is header of all outgoing packet. Once the bit CN is set, after that entire neighboring node stop sending packet to the congested node which helps in clearing the queue packet in the buffer of congested node.[8]

2)CCF
(Congestion Control and Fairness):
This protocol find PST(PST stands for packet service time) to detect congestion. If arrival rate is less than service rate of each intermediate node then there is congestion in that sensor node. It uses hop-by-hop approach. [9]

3) RCRT (Rate-Controlled Reliable Transport):
It forward data from many points–to –single point which gives reliability. It gives E-T-E explicit loss recovery and provides all the congestion detection, rate adaptation and rate allocation service in the sinks.[10]

4) STCP (Sensor Transmission Control Protocol):
Is flexible, E-T-E upstream transport layer protocol that provides both E-T-E reliability and congestion control mechanism? It is a protocol for transmitting multiple streams of data at the same time between two end points that established a connection in network. Sometimes refer to as "next generation TCP" A telephone connection requires that signaling information sent along voice and other data at same time. SCTP is standard protocol (RFC 2960) developed by the Internet Engineering Task Force(IETF). [11]

5) MCCP (Multi-event congestion control protocol):
It uses two parameters for congestion detection, first is buffer size and second is packet delivery time between two sensor node.[12]

6) HTAP (Hierarchical Tree Alternative Path Algorithm):
It controls congestion on the basis of local information by dynamically switching to alternate. In this protocol each node is only connected to those nodes which are in upstream direction i.e. from source node to sink node.
There are many more protocols like ,PHSA(Probability based Hop Selection Approach), SUIT(Sensor fuzzy based image transport), NNBCD(Neural Network Based Congestion Detection protocol) ,FBACC,FCCTF,CONSEQ,IDCCP,SIPHON[13]

Table 2: Comparison of technical features of congestion aware and reliable transport layer protocols.

Transport Layer Protocols in WSN	Reliability level	Reliability direction	Acknowledge	Delay	Caching	Congestion Detection	Energy Efficient	Reliability type
ESRT	Event	Up	---	Large	No	Queue Occupancy	Yes	E-T-E
ATP	Pck	Up	Negative-ACK	Medium	No	Queue Occupancy	No	E-T-E
STCP	Pck	Up	Negative-ACK, error-ACK	Large	Yes	Queue Occupancy	Yes	E-T-E
ART	Event	Both	Negative-ACK, error-ACK	Small	No	ACK received to core nodes	Yes	E-T-E
RCRT	Pck	Up	Negative-ACK, ACK	----	No	Times to recover loss	NO	E-T-E
CTCP	Pck	Up	Double error-ACK	Medium	No	Queue Occupancy, Transmission error loss	Yes	E-T-E
Flush	Pck	Up	Negative-ACK	Small	No	Queue Occupancy, Link Interference	NO	E-T-E

Where,
UP= upstream,
E-T-E= end-to-end,
DW= downstream,
Pck=packet,
DB=destination based,
H-T-H= hop-to-hop,
ACK= acknowledgement
NACK= negative acknowledgement
eACK= error acknowledgement

c)Protocol with mechanism of Congestion Elimination

1) ADMQOS:

It proposed framework for adaptive management of QOS. It proposes a framework in different situation like management of rescue operation and cooperation during a disaster. The proposed framework also adapts its behavior to minimize delay and ensured reliability.[15]

2) OD-AODV:

AODV stands for Ad hoc On-Demand Distance Vector Routing. It is used in order to discover and maintain shortest path. This protocol presence a framework for adaptive routing protocol. This framework defines two paths to transmit data according to their priority. [16]

3) FMUMUWSN:

FMUMUWSN stands for Forwarding Method for Urgent Messages on the Ubiquitous WSN. it is useful to forward urgent messages, even there is packet loss on the wireless links . The urgent messages are send from monitoring node.17]

Table 3: Congestion elimination in urgent protocol

PROTOCOLS	CONGESTION DETECT	CONGESTION AVOID	RELIABILITY LEVEL	RELIABILITY TYPE	ACK
RETPUI	QO and Fluctuation	Multistage Rate adjust	Et	HBH	ACK
FARTM	Urgent Data Occurrence	Implementing Assured path	Et	HBH	ACK
CP-EDCA	Urgency Detection	Normal Data Preemption	Et	HBH	ACK
ADMQOS	Et Detection	Priority wise Distribution	Et	HBH	ACK
OD-AODV	Et Classification	Priority wise shortest path conveyance.	Et	HBH	ACK
FMUMUWSN	Et Classification	Multipath Transmission	Et	HBH	ACK
PAT	Urgent Et	Blocking of normal data	Et	HBH	ACK

Where,

Et: Event

C) Problem Definition: "To Transmit Urgent data using ANKM method"
ANKM method is one mechanism which is used to transmit urgent data, using dedicated path.
All other protocols are just used for reliability purpose or congestion avoidance, congestion detection, congestion elimination purpose. But here we propose one mechanism which is use to send urgent data as well as normal data

Goal: Traditional Transport layer protocol is not directly used to send urgent data before transmitting normal data. So here we try to send urgent data using assured path. Which conserves the property like congestion avoidance, congestion elimination and Reliability .This mechanism can be used in the area of military, earthquake.

D) Proposed System:

Design and implementation of ANKM method.

Network architecture
Here the ANKM method is implementing at transport layer.

Assured Path Data Transfer
ANKM method is used in three phases:
a) Firstly, using the assured path for data transmission.

b) Transmission of urgent data using reliability mechanism.
c) network is again available for normal operation.

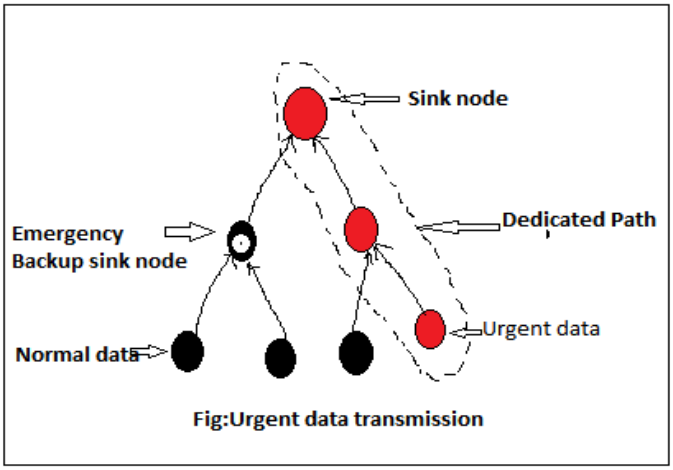

Fig:Urgent data transmission

PAT:
Lots of protocols are useful in forwarding urgent information. In PAT, sensors sends request to sink node for transferring urgent data, then sink node block all the

transmission of normal packet by sending a blocking request. Existing systems for Urgent data transmission mainly focused on the only transmission of urgent data. Proposed scheme aims not only transmission of urgent data packet but also the normal data packet at the same time. In existing PAT scheme, while transmission of urgent data (sensitive) from sink node to sensor node, all the normal data get blocked to avoid the congestion and provide 100 % reliability for urgent data but at the same time normal data is generated at other sensor node and due to blocking request from sink node, sensor node don't send the data in the network even if the urgent data transmission is not in the vicinity. And which result in normal data packet generated at sensor node could not store at node due to less memory. In the proposed scheme, this issue is resolved by using intelligence. It works in three phases, when sensor node has urgent data information ,it send UREQ (urgent data request) to the sink node .This request will reach to the sink node via number of hops .The intermediates node will add their ID information to the request packet. When sink node receive the request packet, It immediately broadcast the blocking request which contain the ID information of intermediate node which received in request packet. When all other nodes will receive the blocking request it compare it's all neighbor ID and all ID contained in blocking request .If it found any neighbor ID in the blocking request ID list then it will block the normal data and if not then it will forward the normal data toward the sink node. Also when Sink node broadcast the blocking request, immediately its one hope neighbor node send the status information i.e. currently available power occupancy to the sink node. When this information contained packet received at sink node,it will select one of them as a backup sink node and broadcast (BUPSINK) request so that all other normal data generator node transfer data to the backup sink node and urgent data is transmitted to the original sink node .Finally when urgent data transmission is completed then original sink node will broadcast the block release request. When this request is received at backup sink node, it will start sending normal data which is aggregated from normal data generator node.

E) Conclusion:

In this paper, a survey of variety of protocols used for congestion control (CC) is originated. Congestion detection and control in wsn different types of protocols used and also some other protocols discussed in detail which have been recently proposed. WSN has many applications where time critical and urgent information needs to be transferred to the sink node. There are many protocols presented for this cause. In summary we concluded to transfer urgent information necessity of clear path assurance.

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