Contribution to the technical and QoS algorithms in wireless sensor networks

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1. Motivation of the work

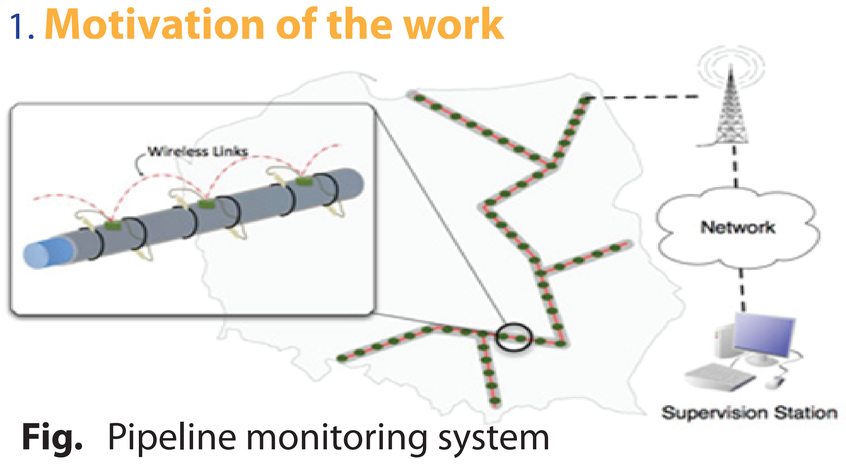
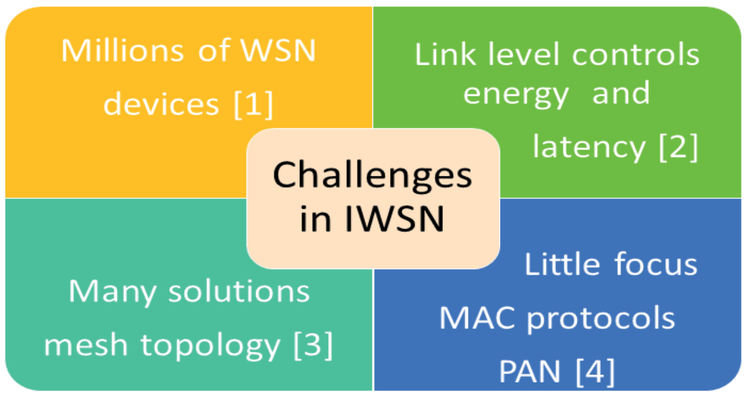


Fig. Pipeline monitoring system

Linear infrastructures are a very important asset. Its monitoring requires specific wireless networks that have particular challenges that must be studied and solved.



2. Thesis Objectives

- **Introduce the implicit acknowledgement technique**
- **Take advantage of linear topology and CSMA/CA**
- **Advance in the monitoring technology linear structures with WSN**
- **Propose a novel protocol scheme**

3. Research Plan

- **2015**
  - State of art.
  - New communication scheme.
- **2016**
  - Validate the proposed solution.
  - Publication of results
- **2017**
  - Publication of results
  - Further contributions experiments and analys
- **2018**
  - Presentation of dissertation

4. Results:

Progress has been made in the LWSN and the first results have been published

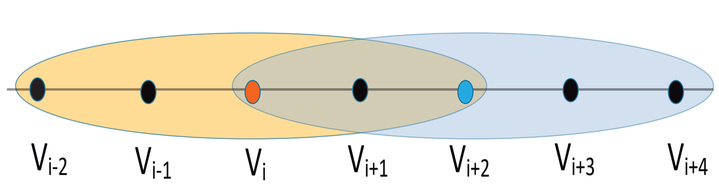


Fig. Coverage node in LWSN, IEEE 802.15.4

LWSN Scenario:

- **Each node has conectivity with four nodes.**
- **Range is about 60 meters without obstacles.**
- **IEEE 802.15.4 link level protocol, unslotted mode (CSMA/CA).**
- **WSN with large scale linear structure (thousands of nodes).**

4.1 Paper "Automatic allocation of identifiers in linear wireless sensor networks using link-level processes"[5]

Published, IEEE LATINCOM 2016 conference

Contribution:

- Use of implicit ACK (iACK) to provide network reliability in the network, instead of explicit ACK (eACK)

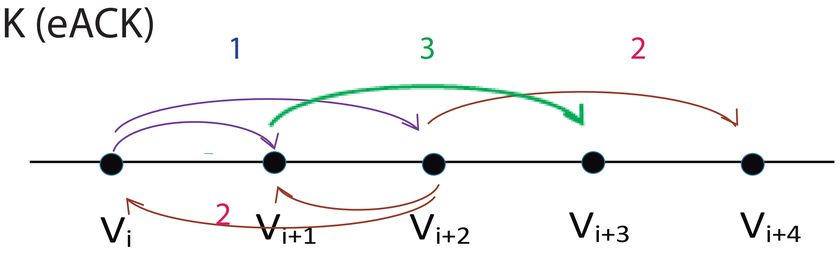


Fig iACK

1. v_i node transmits frame to v_{i+2}, the signal reaches node v_{i+1}.
2. When node v_{i+2} transmit to v_{i+4}, the frame is received in node v_i and v_{i+1}. If node v_{i+2} does not retransmit the frame to v_{i+4}, then the frame received is wrong or the link is failed.
3. If node v_{i+2} is failed, the node v_{i+1} retransmit the frame to node v_{i+3}.

- Fixed location and received power level facilitate the location of the nodes in the linear infraestucture.
- Identifiers are assigned secuencialitly.
- The link layer provides information to make possible the automatic allocation.

4.2 Journal Draft paper "Novel routing protocol link level- based using implicit ACK "

Contribution

- Reliable transmission, using iACK, reduce delay times produced by the use of acknowledgment frame.
- When iACK is used to provide the same reliability as eACK, the delay is reduced by a 9%. with LIFS and 8% with SIFS.
- Reliable transmission with failed nodes and failed links without using routing protocols, reducing computing in the node eliminating network level.
- Assigning Addresses to nodes using Link-Level processes.
- The delay evaluated with iACK between the sensor node to the border node, is reduced by 9%.
- The additional consumption of energy, to confirm the frame received, using eACK, in the node, is about 26% of the energy consumed by the node.

TABLE : Variation of energy consumption in the sensor node with ID = 16 Bits

Payload(byte)	AEr	AEsf	AEef
18	26%	47%	-12%
114	9.63%	24.90%	-5%

AEr = The percentage of additional energy consumed , using eACK
AEsf = The percentage of additional energy consumed , to send the second frame, using eACK
AEef = The percentage of additional energy consumed to retransmit the erroneus frame with eAck

5. Next Year Planning

- **Further contributions.**
- **Publication of results.**
- **Write the dissertation.**
- **Present the thesis.**

6. References

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[5] Automatic allocation of identifiers in linear wireless sensor networks using link-level processes, **Carlos Egas**, Felipe Gil-Castiñeira, Enrique Costa-Montenegro, 8th IEEE Latin-American Conference on Communications (LATINCOM), November 2016

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