Contribution to the technical and QoS algorithms in wireless sensor networks

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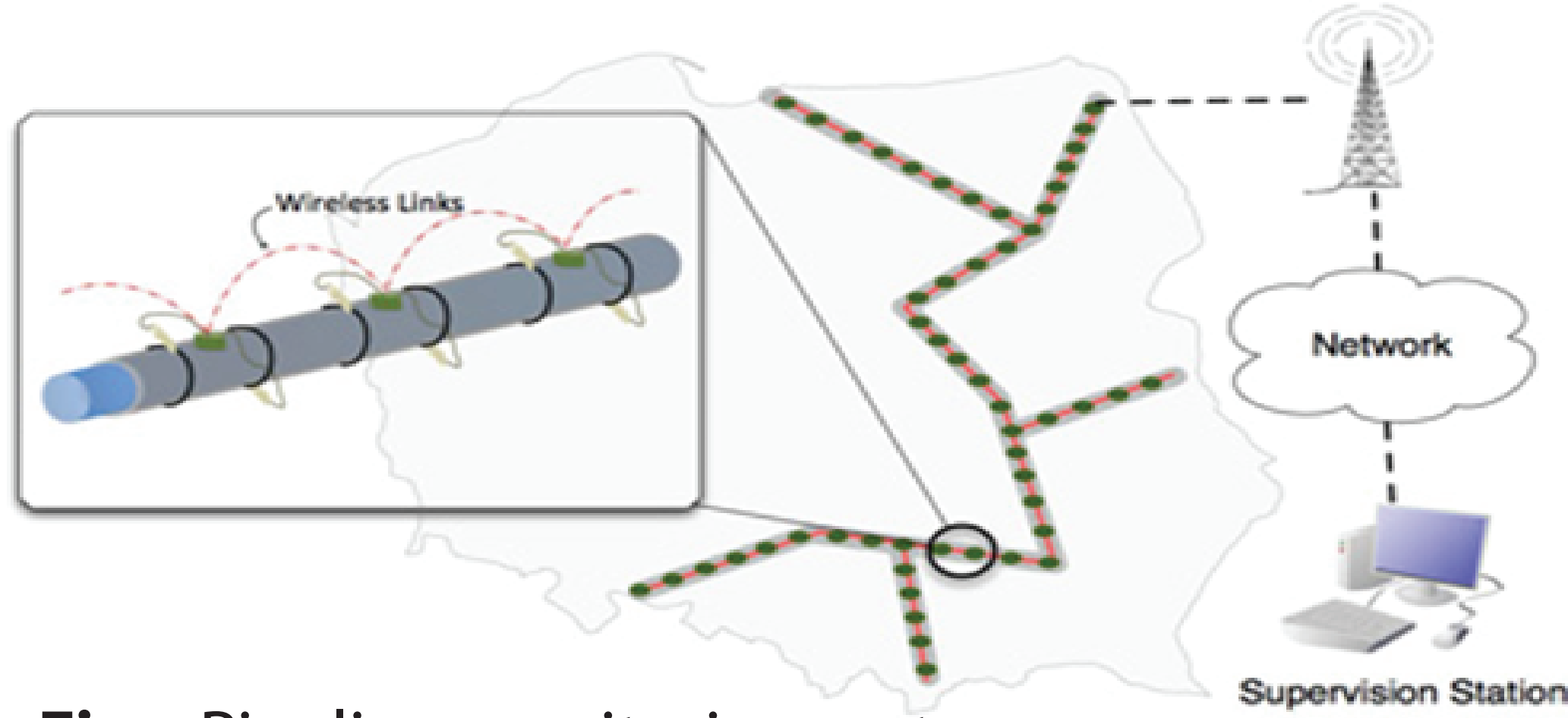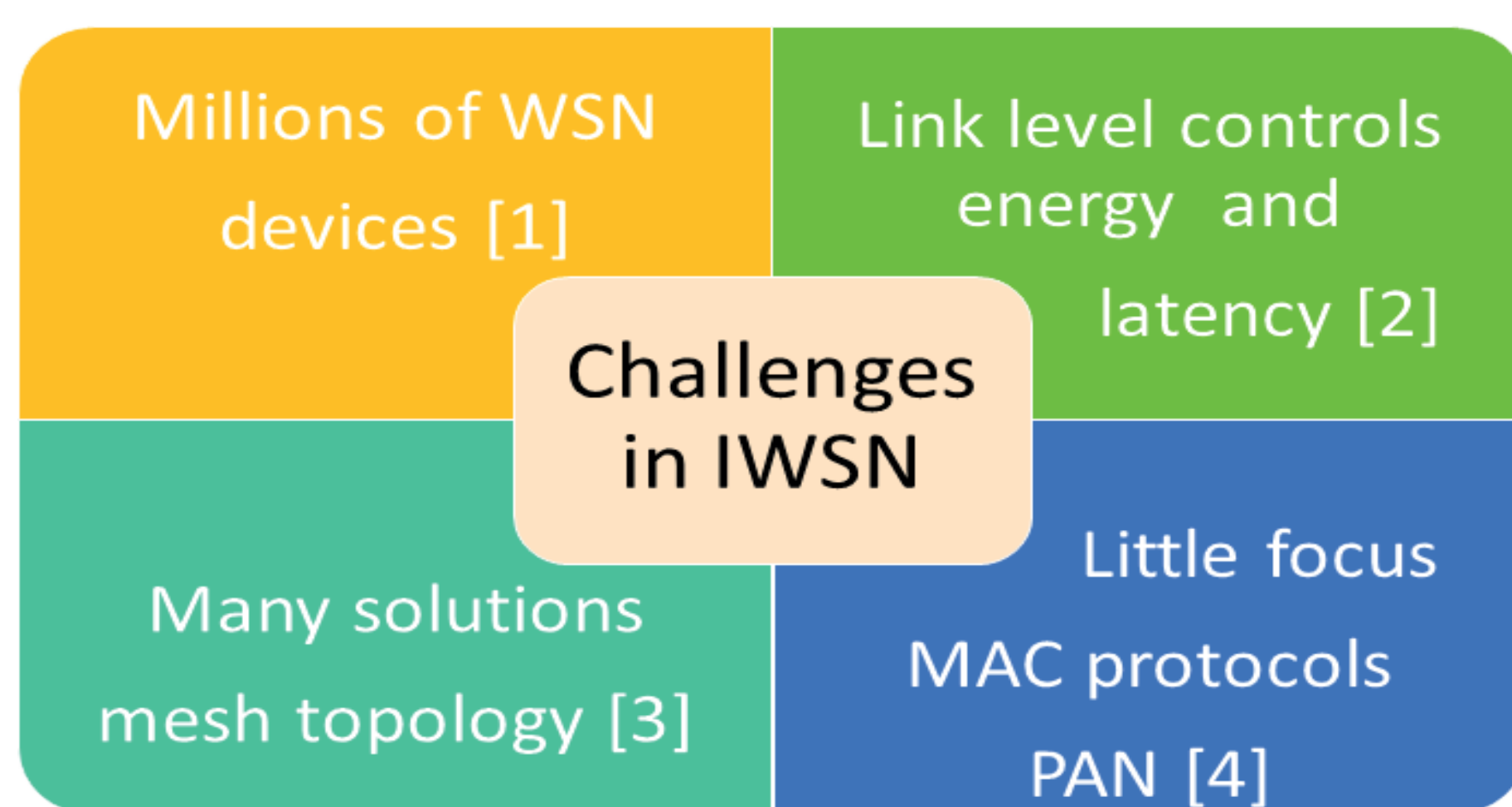
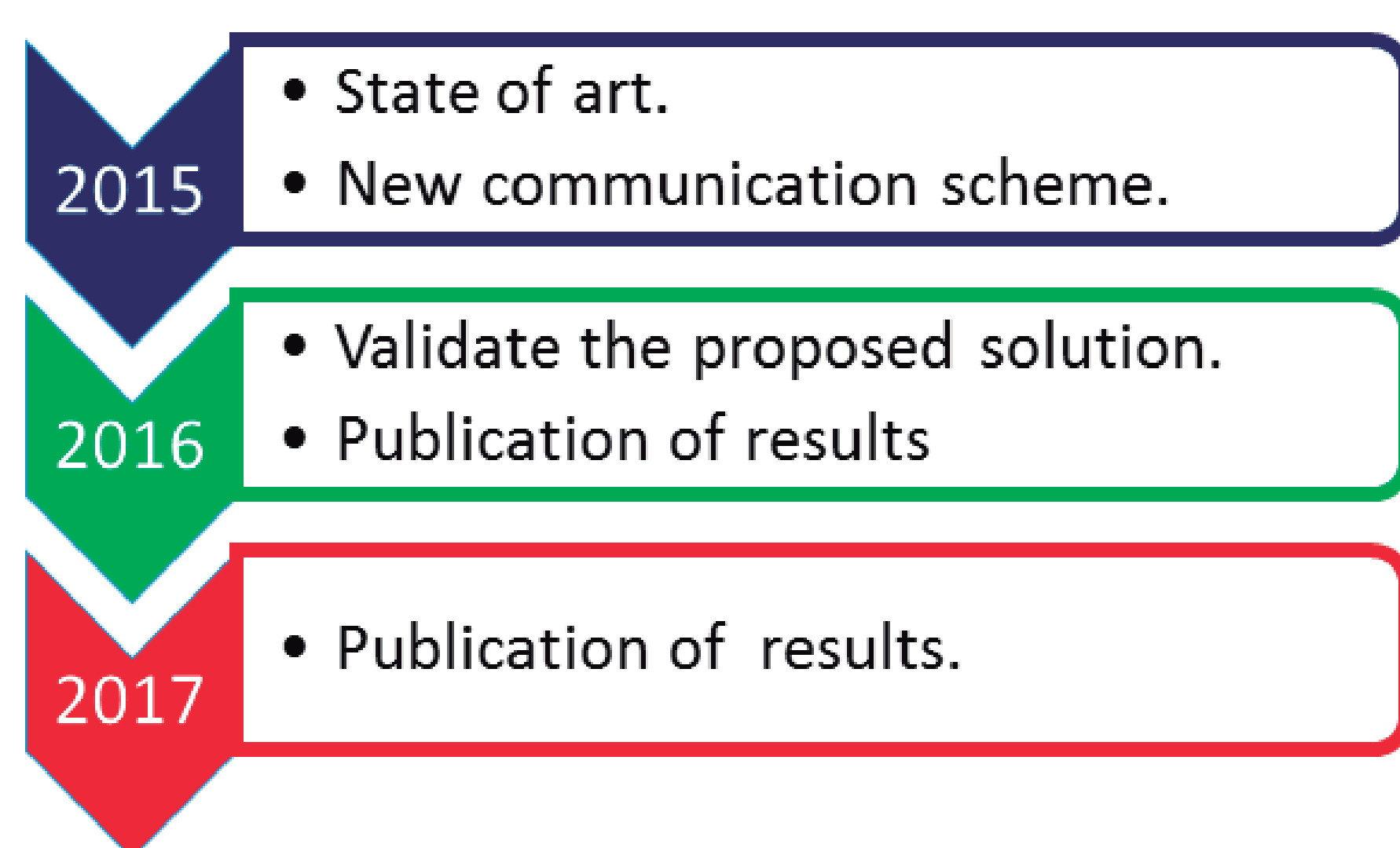## 1. Motivation of the work

Fig. Pipeline monitoring system

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

Millions of WSN devices [1]	Link level controls energy and latency [2]
Challenges in IWSN	
Many solutions mesh topology [3]	Little focus MAC protocols PAN [4]

2. Thesis Objectives

- **Introduce the passive acknowledgement technique**
- **Take advantage of linear topology and CSMA/CA**
- **To advance in the technology of monitoring of 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.

4. Results:

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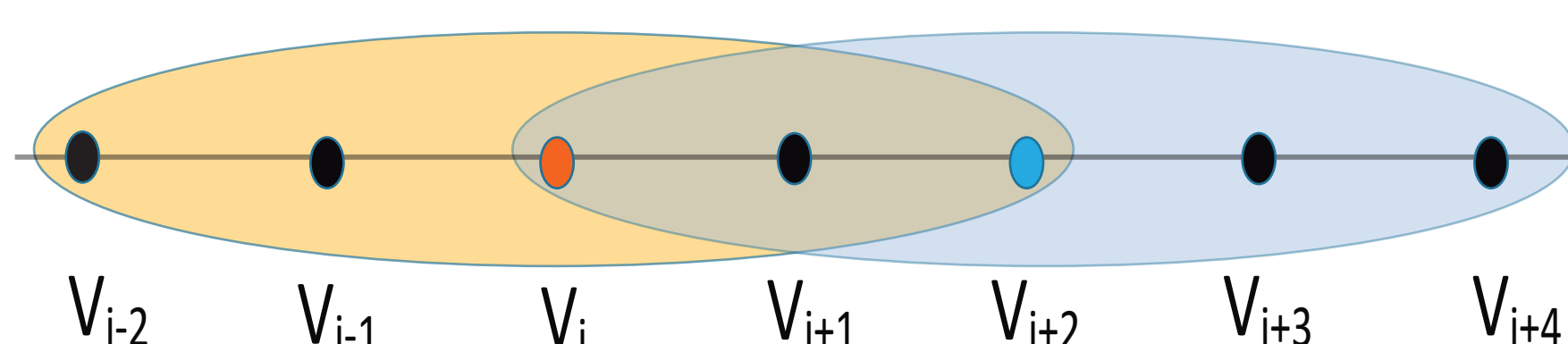

Fig. Coverage node in LWSN, IEEE 802.15.4

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:

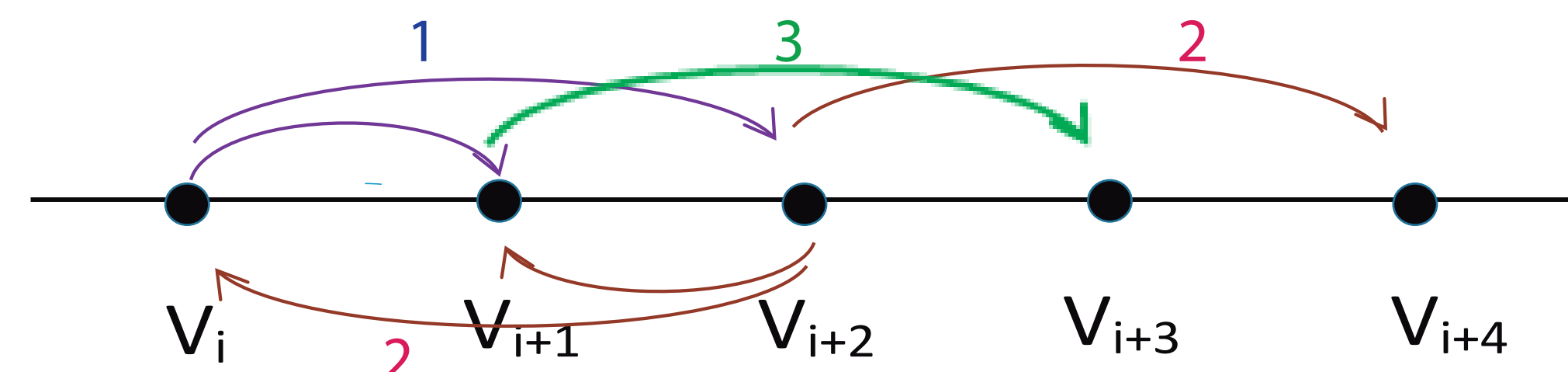- Use of passive ack to provide network reliability

Fig.   Passive ACK

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. Therefore nodes v_i or v_{i+1} send again the frame to node v_{i+4} ,without receiving the ACK frame.
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.

Fig. Nodes used for testing   **Fig.** Test Network

4.2 Journal Draft paper "Novel protocol using passive ACK to provide reliability in LWSN with 802.15.4 "

Contribution:

- Reliable transmission, using passive ACK, reduce delay times produced by the use of acknowledgment frame.
- Reducing the delay time due to frame retransmission in the relay node.
- 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.
- Reducing the time of transmission of data from the sensor node to the border node.

5. Next Year Planning

▲ **Publishing in Journal. "Novel protocol using passive ACK to provide reliability in LWSN with 802.15.4"**

▲ **Attend conference on IoT**

▲ **Writing Thesis**

6. References

[1] Digital Oilfield Wireless Sensor Networks A Market Dynamics Report, Mareca Hatler, Darryl Gurganious Published: Q4 2014
[2] An Industrial Perspective on Wireless Sensor Networks, A Survey of Requirements, Protocols, and Challenges A. Kumar S., Vsthus, L. Kristensen. IEEE Communications surveys & tutorials, Vol. 16, No. 3, Third quartesr 2014   pag. 1391 -1412
[3]Wireless Sensor Networks for Long Distance Pipeline Monitoring, A. Azubogu, V. Idigo, Engineering and Technology Vol:7, 2013 ,pag 78- 82
[4]Mac layer protocols for linear wireless sensor networks: a survey. Radosveta Sokullu, Eren Demir Recent Advances In Telecommunications, Informatics And Educational Technologies, 2014, 247-256
[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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