INFORMATION OF DOCTORAL DISSERTATION

Research title: **Reducing end-to-end latency and total energy consumption in wireless sensor networks**

Major: **Computer science**

Major code: **62480101**

PhD student: **Huynh Trong Thua** (Huỳnh Trọng Thưa)

Scientific advisors:

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Dissertation Summary:

This thesis focuses on researching and designing the clustering algorithm in combination with the multi-hop routing algorithms between clusters to address specific goals:

- Minimizing computational complexity and exchanged control messages for sensor nodes in order to save energy consumption and delay by processing and communication.
- Reducing end-to-end delay due to data delivery from source sensor nodes to the base station.
- Balancing the energy between sensor nodes to extend the lifetime of the whole network.

To accomplish the above goals, the dissertation focuses on the following contents:

- Clustering for sensor nodes.
- Multi-hop routing algorithms in wireless sensor network.
- Network scheme và routing algorithm to save energy consumption and ensure requirement of end-to-end delay in wireless sensor network.

Results of the dissertation:

The dissertation has achieved the research objectives and suggested contents under the proposed algorithms as follows:

- Clustering algorithm: Along with proposing a clustering algorithm to trade-off the consumed energy and end-to-end delay, this dissertation also design an aggregate cost function based on the remaining energy level of each sensor node and distance between them to select the optimal cluster head nodes for distributing data to the base station in the most efficient way.
- Routing algorithm to trade-off the consumed energy and end-to-end delay: The dissertation proposes a cost function to combine both energy consumption of each sensor node and link delay between neighboring nodes. In addition, the dissertation also proposes an updating algorithm to recalculate and update the cost function for distribution data to the base station along the path that has the lowest combined cost.
- Energy efficiency routing algorithm with *k* shortest paths ensuring the end-to-end delay: The dissertation proposes a cost function based on only the remaining energy of each sensor node and a routing algorithm with *k* shortest paths on the total energy consumption ensuring the end-to-end delay constraint of application.
- Distributed algorithm for delay constrained energy efficient routing: The dissertation proposes an algorithm to select the optimal cluster head nodes on energy consumption while ensuring requirement of end-to-end delay to be the data forwarding node based on only the local information between neighboring nodes. This reduces the amount of overhead exchanged in the process of route discovering and make the algorithm to achieve fast convergence.

Practical applications of dissertation's result:

In the proposed algorithms of the dissertation, it is easy to see the potential of their applications in reality is immense. This may indicate a few applications can be effectively applied the clustering model and proposed routing algorithms in reality such as: forest

fire monitoring system, monitoring system of volcanic activity, earthquake and/or tsunami warning system, intrusion detection systems and various other applications that require sensitivity in the information response time.

Further research of the dissertation:

Although the clustering model and the proposed routing algorithms showed significant improvement on energy savings and end-to-end delay reduction in wireless sensor networks, they are still some limitations such as: the method of determining the optimum number of hops in a general network size has not been specified, the complexity of the control messages exchanging is still a polynomial function. Therefore, the dissertation proposes another potential research that is the swarm optimization method to distribute the sensor nodes in to the network suitably in order to get the better balance on energy consumption and communication delay.

Scientific advisors		**PhD student**
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