An Adaptive Security Protocol for a Wireless Transmission Line Monitoring Network in Smart Grid

Feng Ye, *University of Nebraska-Lincoln*

In this research, we propose a new security protocol for a wireless sensor network which is designed for monitoring long range power transmission lines in smart grid. As shown in Fig. 1, part of the monitoring network is connected by optical fiber composite overhead ground wire (OPGW) and thus it can be secured with conventional security protocol, however, the wireless sensor network between two OPGW gateways remains vulnerable. Our proposed security protocol focuses on the wireless sensor network part, it provides mutual authentication, data integrity, and data confidentiality for both uplink and downlink transmission between the sensor nodes and the OPGW gateway. Besides, our proposed protocol is adaptive to the dynamic node changes of the monitoring sensor network, e.g., new sensors are added to the network, or some of the sensors are malfunctioning. We further propose a self-healing process using an "i-neighboring nodes" public key structure and an asymmetric algorithm. We also conduct energy consumption analysis for both general and extreme conditions to show that our security protocol improves the availability of the monitoring sensor network. In addition, the numerical results show that our proposed "i-neighboring nodes" public key structure can reduce the end-to-end delay.