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REACHING CONSENSUS UNDERLYING AN AUTONOMOUS LOCAL WIRELESS SENSOR NETWORK

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Abstract. *Wireless sensor networks have been practically applied to many fields including industry, science and environment monitoring. A traditional wireless sensor network is likely composed of several distributed sensors and a limited number of sinks. The sinks gather the sensed data from sensors for further analysis and then make the actuators take corresponding actions according to the analyzed result. A sensor-sink based architecture is vulnerable to the sink failure problem. Meanwhile, if a sensor does not have a direct link with the sink, it must deliver sensed data by hopping through other sensors. The sinks may take a long time to collect data and to make the final decision. On the other hand, unexpected faulty sensors may result in an incorrect decision. Based on above, we propose an autonomous wireless sensor network to make a local decision based on the regional sensed data to raise the efficiency of action taking. Our proposed scheme uses a consensus based algorithm to improve the fault resilience. In this article, we prove the correctness of the proposed scheme and analyze the computation complexity.*
Keywords: Autonomous, Wireless sensor network, Consensus, Fault resilience

1. **Introduction.** The wireless sensor network (WSN) has widely applied to various applications, such as military monitoring and environment detecting [2, 5-6, 13]. The traditional WSN architecture comprises several sensors and a limited number of sinks. The sensors are in charge of detecting the environment status, which may vary with time and space; relaying data for other sensors; and transmitting the measured data to the sinks. The sinks must collect and analyze the data received from sensors and then make a final decision according to the analyzed result. When sensors do not have a direct link with the sink, the sensed data must be delivered by hopping through other sensors. The operation diagram is shown in Figure 1.

With improvement in the miniature sensor, faster wireless communication and low power consumption technologies, wireless sensors are deployed more easily and are able to execute data computation. Currently sensors can not only monitor the environment, but handle received data by cooperating with other sensors. Meanwhile, the sinks in a traditional WSN may take a long time to collect data hopped from other sensors. When the WSN application has the emergence characteristic, it needs to take further actions immediately according to the detected data from the sensors. Hence, a time-consuming procedure is not suitable for a time-sensitive environment. In addition, a traditional architecture may suffer the failure problem from the limited number of sinks. Once any sink in the WSN malfunctions, the system may not react correctly. For example, a failed