

pollution monitoring round the clock and online reporting [26]. The latest technology is Electronic Tongue to monitor agriculture and industrial pollution of air and water. Industrialization is for growth of the people, at the same time that must assure the secure lifetime of the people. Therefore there is a need to increase implementation of WSN in this direction also.

4. WSN Challenges in industrial environment

Even though there are so many advantages in using WSN in industries, there was a serious debate over whether or not WSNs and wireless communication in general were a technology suitable for industrial applications. To create robust network architecture, it is crucial to know the differences among all the wireless standards.

From industrial point of view, ISA SP100 workgroup introduces the following six classes (Class 5 – Class 0) for wireless communications based on analysis of industrial, inter-device wireless communication applications [27].

Class 5

- *items related to monitoring without immediate operational consequences.
- *without strong timeliness requirements
- *reliability requirements may vary

Class 4

- *monitoring with short-term operational consequences
- * high-limit and low-limit alarms and other information
- * require further checking or involvement of a maintenance technician. Timeliness of information in this class is typically low (slow)

Class 3

- * open loop control applications, in which an operator, rather than a controller, “closes the loop” between input and output.
- * The time horizon for this class is in a human scale, measured in seconds and minutes.
- *an operator could take a unit offline, if required.

Class 2

- *consists of closed loop supervisory control, and applications usually have long time constants
- * with the time scale measured in seconds to minutes

Class 1

- *closed loop regulatory control, includes motor and axis control as well as primary flow and pressure control.
- * The timeliness of information in this class is often critical.

Class 0

- *emergency actions related to safety, which are always critical to both personnel and the plant.

- *Most safety functions are, and will be, carried out by dedicated wired networks in order to limit both failure modes and vulnerability to external events or attacks. Examples in this category are safety interlock, emergency shutdown, and fire control.

There are number of challenges in migrating from a wired to WSN implementation [28].

- * Coverage area of the network may suffer in the industrial environment due to various interferences.
- * The reliability and the signal strength may get affected due to the reflection from the walls, interference from other devices or machines and interference from the environment itself.
- * Time delay through the network from sensor to monitoring site.
- * Balance between battery life and data update rates.
- * Power management and harvesting technologies
- * Wireless network advances like ISA 100 and wirelessHART make WSN a more viable possibility in traditional manufacturing environments, but the challenge of latency remains.
- * WSN protocol requirements, network architecture that is suitable topology
- *Suitable wireless standards, bandwidth, dropped packets rate, throughput tradeoffs
- * Special computers called PLCs are used to automatically interpret the data collected from sensors and events on a continuous basis and use this output to trigger certain actuators and events.
- * Co-ordination between several technologies ranging from information systems to computer controlled machinery.
- * As wireless is the best way for disparate, dispersed automation, wireless networks should be capable of integrating with standard plant and office networks [29]
- * With so many network and volume of communication, security is a critical aspect.
- * Longevity – lifetime of a sensor and sensor network
- * Standard in data access specification
- * Data access specification in Multi model arrays of sensors to capture a complex scene.
- *Method to convert raw data from sensor to useful information and data redundancy
- * Instead of passing large volume of data from WSN to destination, other option is better data aggregation
- *QOS requirements

5. Conclusion

The industrial wireless business and use of WSN continues to grow fast every year. At the same time challenges are also there and depend on application and industrial environment. There is a need to concentrate on areas where the challenges and apply WSN to get

information and run processes more effectively and improve safety and production.

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