RESEARCH AND DEVELOPMENT

Supervisor / Name of the Researcher	Department	Research topic	Year of completion/Ongoing
Dr. Z.J. Khan Satyanarayana Chanagala	Electronics and Power Systems	Investigations on development of Wireless Sensor Networks for extended lifetime performance	Ongoing

BRIEF SUMMARY OF THE WORK: This work is on the verge of completion as a part of Doctoral work undertaken at RCERT, Chandrapur. Wireless Sensor Networks (WSNs) technologies are considered to be one of the reckoned fields of the twenty-first century. This field is making inroads into every sphere of human life. Empowered by developments in associated technologies like micromechanical systems (MEMS) and ultra-very large scale integration (UVLSI), the field of wireless sensor networks aims at manufacturing miniaturized, low cost and intelligent sensors. Hence, a given physical area of interest can be densely populated with these sensors, which can be networked through wireless communication links. The internet connection to this network provides myriad prospects for a variety of applications like environmental monitoring, monitoring of war zones, health monitoring of human beings, applications related to industrial process control and many more. Unlike the conventional wireless communication networks, wireless sensor networks are characterized by constrained energy, limited processing capacity, finite storage, and limited bandwidth.

The conflicting requirement of longer life with the constrained energy source of a sensor node has attracted many researchers in the recent times. Particularly when the sensor nodes are deployed in the hazardous environments and impenetrable terrains, it is difficult and most of the times impossible to replace the drained batteries of the sensor nodes. Thus the lifetime of the sensor node depends on the lifetime of the battery. The electrochemistry characteristics of battery viz. rate-capacity effect and recovery effect have an enormous effect on the lifetime of a battery. Further, the lifetime of the battery used to energize sensor node is also affected by sensor node parameters viz. sampling interval and transmission power level of the sensor node. An arbitrary choice of these parameters many times could result in premature exhaustion of the battery. One more factor that influences the lifetime of the battery of the sensor node is the environmental conditions of the sensor field. If the wireless sensor network is deployed in colder conditions, the lifetime is shorter than the expected value. This is due to the decrease in the mobility of ions in the electrolyte of the battery which manifests as increased internal resistance of the battery.

The research work carried out focuses on finding the optimum values for sampling interval and transmission power level to mitigate the detrimental effects of recovery and rate-capacity of the battery of the sensor node. Further, an extensive investigation was undertaken to understand the impact of sensor field temperature on the life of the battery. The important bottleneck of the early drain of the battery at the lower temperature is mitigated by compressing the sensed data and operating the sensor node at the optimum sampling interval and the optimum transmission power level.

The final outcome of the Research work is encouraging as the lifetime of the sensor node is pushed up by another 35% with the suggested methods.

INDUSTRY RELEVANCE: The work carried out is indispensable in the context of networked societies where sensor nodes have very vital role to play.

RESEARCH OUTCOMES: 1. A National patent has been registered. 2. Authored a text book chapter, published by ©Springer-Verlag GmbH Germany, part of Springer Nature 2019 3. Six Journal papers and three international conference proceedings.