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Review

Applications of wireless sensor networks for urban areas: A survey

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ABSTRACT

As new wireless technologies become more and more advance so does their expanse of applications. Among other new and innovative wireless networks, Wireless Sensor Networks (WSNs) have emerged as highly flexible and dynamic facets that are being deployed in almost every type of environment whether it is rural, suburban or urban in nature. The most adaptive and innovative research avenues are being considered in an urban environment, where WSN deployment is especially demanding due to its harsh and perverse channel conditions. We have chosen WSN deployment in an urban environment as linchpin of our research. As each application scenario is different from the other, therefore WSN solution for each application has to be adaptive and innovative. We have discussed each application of WSNs in urban areas in detail with all the problems related to it and in the end, technical solution to those problems has been discussed.

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1. Introduction

Real life events are transformed into data that can be processed, saved and used later for different purposes by sensor nodes in WSN. Each sensor node is modified distinctively in accord with their environment e.g. if sensor node is installed underground then it will have transceivers that have high transmission power in order to overcome noisy channel attenuations, while if sensor is placed in a marine environment (Hendee et al., 2012; Albaladejo et al., 2010) then their outer shell/encasement will be designed to withstand the effects of salinity, moisture and being water proof would be another important feature. These sensor nodes then convey the changes in environment to the main server where real time decision making takes place. Sensor networks help in preventing catastrophic failures through continuous and reliable monitoring (Dargie and Poellabauer, 2010).

The miniaturization of electronic devices has promoted WSN deployment to the extent that high power consumption is no longer a big issue for large scale remote installations. As the technical issues in WSNs are being solved, their expanse of applications has also widened. In general, wireless sensor networks are installed on ad hoc basis which makes it easy to deploy. Wireless sensor networks utilize the sensor nodes to sense the changes in surrounding environment and relay the information via various methods to remote control center. Figure 1 represents common topologies of information flow in wireless sensor networks. In the left most corner of Fig. 1, a sink node that gathers or collects the data from all the other sensor nodes is considered. A sink node can have same specifications as the other sensor nodes or it can consist of a customized device like a PDA, laptop etc. which in turn connects the sensor network to other networks. Similarly a sink node can consist of a base station that links the network data via Internet to the remote control/monitoring center.

WSNs are being used for intelligent monitoring of temperature, humidity, water level, pressure, vehicular activity on roads, strength of mega structures like bridges, tunnels and buildings, criminal surveillance in alleyways and roads, remote health monitoring of multiple patients and many other applications (Akyildiz et al., 2002; Yick et al., 2008). As mentioned earlier, each WSN deployment is dependent on and has to be modified keeping

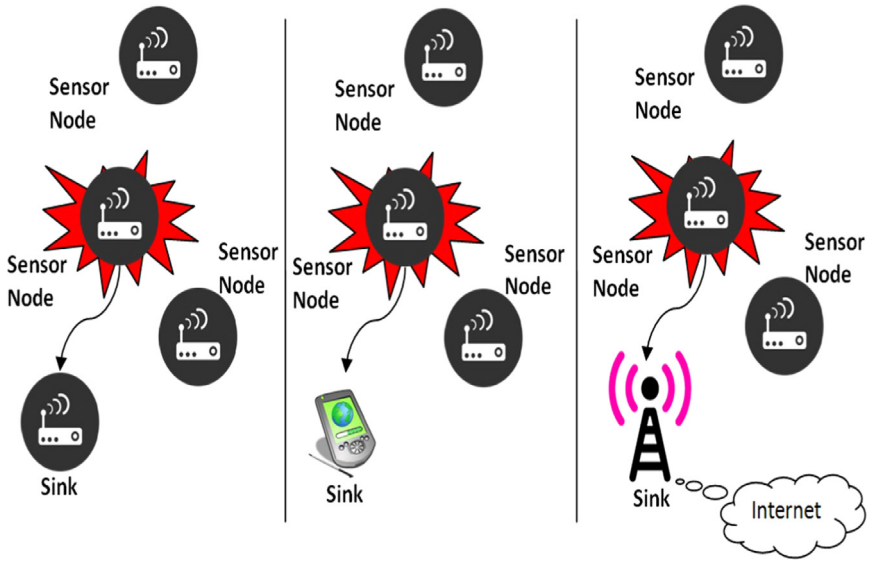

Fig. 1. Prospective architectural topologies of wireless sensor networks.