Providing Communication Gateways for In-Situ Environmental Monitoring with Wireless Sensor Networks

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Abstract - The Sensor Networking and Wireless Workgroup in the School of Engineering at the University of Vermont has been utilizing wireless sensor networks, or WSN, technology to monitor Snow Water Equivalence (SWE), which is a measure of how much water is inside a pack of snow. Modern day advances in low power integrated circuit design along with the manufacturing of smaller computer processors and radio chips have enabled the development of cheap, easy to deploy WSNs. The ability of these small wireless nodes to be easily coupled with nearly any off-the-shelf sensor has made the consideration of many different types of in-situ monitoring feasible, where traditional sensing deployments would have been prohibitively invasive, energy consumptive, dangerous or costly to install. Thus, one of the many research areas to benefit from this new field of WSN technology has been environmental monitoring. In the case of SWE monitoring, the currently used method is to implant giant snow pillows filled with antifreeze into the environment. This is a difficult, invasive, costly method that is also susceptible to natural effects such as snow bridging. In contrast, the SWE system is lightweight, easy to deploy, cheap, and minimally invasive in comparison. The current configuration of the SWE monitoring network relies on an in-situ gateway node to relay the gathered SWE data from the network to the desired end user via radio or cellular modems. As an addition to this on site communication gateway, this work employs the use of a micro-aerial vehicle, or MAV, to act as a data mule, granting further communication options and redundancy to remotely acquiring data from the stationary network. The use of this mobile gateway also has the potential to alleviate the energy burden of the “hot spot” nodes closest to the stationary gateway.