Characterizing an Impact: Event Monitoring with a Wireless Sensor Network

Most wireless sensing networks (WSNs) assume periodic sensing, where sensors continuously measure a phenomenon (like ambient temperature) and report that data at regular intervals to an end user. However, as WSNs grow in use and sophistication, they will be increasingly deployed for event-driven applications such as early warning systems. In event-driven applications, data is only generated when an event occurs, and events often occur at unpredictable times.
Event-driven applications pose a unique set of challenges to WSNs. At the node level, the WSN must be able to generate enough data to fully characterize rapidly changing phenomenon. At the network layer, WSNs must send that information in a timely and accurate fashion through the network to the end user. In order to study the challenges posed by event-driven WSN deployments, I will monitor the effect of an impact on an object, transmit that data through a multi-hop network, and use that data to produce a computer simulation of the impact. This research project will thus consist of three distinct parts: (1) the integration of node layer hardware, including sensors, a micro-controller, and a transceiver; (2) the development of a multi-hop network that can be "woken up" when the impact event occurs and deliver the requisite information to an end-user; and (3) computer modeling - recreating the event using the received data. The third part of this project will prove the accuracy and robustness of the WSN, while the first two will constitute the bulk of the WSN design. Specifically, 6 to 10 slalom gates, each with a wireless sensor node and an accelerometer,. will be placed in a field. The accelerometers will sense any impacts, and the network of slalom gates will deliver the data to a laptop for modeling.