Poster Abstract: From traditional mote style sensor networks to Smartphones - A bridge in the gap

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In sensor networks, researchers have been looking at either mote based sensing platforms or at smartphones(which are currently well endowed with sensors such as Accelerometers, microphones, cameras, etc). But multi modal systems often require both mote based sensing modalities and leveraging the sensors and the processing capabilities of a smartphone. One classic example of such as system is AutoSense which is a body area network designed for the measurement of physiological parameters of stress, that combines the low power sensing capabilities of mote based sensor networks and the ubiquity of smartphones to derive multi modal inferences. But in order to make all this possible, the fundamental question is how do we connect a mote based sensor network which typically communicates on a Zigbee(802.15.4) radio and smartphones which typically have bluetooth, wifi and gsm radios.

We solve this problem by designing a new node which is a bridge between the mote based sensor network and the Bluetooth enabled smartphone. This node has both a zigbee radio, and a serial Bluetooth module which talks to mote class devices via the zigbee radio and a cellphone that have Bluetooth with the Serial Port Profile via the Bluetooth module. We implement a buffering scheme on the bridge node to increase reliability of the end to end packet delivery ratio. We do not use any acknowledgements, yet can get up to a 97% packet delivery ratio. Our current lifetime of the bridge node is around 7 hours with a fully charged lithium polymer battery. We are implementing a duty cycling and packet bundling scheme on the bridge nodes to increase the lifetime to 24 hours.

The appeal of our solution lies in the fact that given a bridge node we can connect any traditional zigbee based sensor network and connect it with a Bluetooth enabled cellphone. We implement a supporting stack to receive data from the body area network on the Android OS for the HTC G1 phone. The data comes in as a raw byte stream which has to be converted into their original message structure, to identify headers and data from the original byte stream. We used the producer consumer problem to model the parsing process. The packets get delivered to other applications on the android platform. So essentially, the android phone can act as a gateway, or as an inference box. Our collaborators have built stress inference and physical activity inference systems out of this. Another advantage of the software implementation is being able to represent equivalent virtual mote sensors on the phone as if they were phone sensors.

We also implemented a simple software on MOTOROLA ROKR E2 and telosb to show the ubiquity of our solution. This enables people with older cellphones to have sensing capabilities on the phone.