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A Mobile Gateway for Remote Interaction with Wireless Sensor Networks

Philip Angove, Michael O’Grady, Senior Member, IEEE, Jer Hayes, Member, IEEE, Brendan O’Flynn, Member, IEEE, Gregory O’Hare, and Dermot Diamond

Abstract—Wireless Sensor Networks (WSNs) almost invariably support a centralised network management model. Though the data gathering function is conducted remotely, such data is usually routed via data sinks to central servers for processing, storage, visualisation and interpretation. However, the issue of supporting remote access to WSNs and individual sensor nodes whilst in their physical environment has not been viewed as a priority. It is envisaged that this situation will change as WSNs proliferate in a range of domains, and the potential for supporting innovative revenue-generating services manifest themselves. As a step towards realising such access, a mobile gateway has been designed and implemented. This gateway supports Zigbee as this is the predominant protocol supported by WSNs. Furthermore, it also supports Bluetooth, thereby facilitating interaction with conventional mobile devices. The gateway is programmable according to the needs of arbitrary services and applications.

Index Terms—Wireless Sensor Networks, remote access

I. INTRODUCTION

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device can remain in sniff mode (as a discoverable slave), scanning for nearby nodes. This is of particular importance in the case of low duty cycle nodes that remove BT power to save energy. Serial communications protocol ensures successful BT transmission, that is, Quality of Service (QoS), with minimum power by utilising a handshaking command set, including, in addition to Request To Send (RTS), Clear To Send (CTS), pause, start of frame and End of File (EOF) eliminators. Wasp mote [9], recently released from Libelium, has a similar hybrid RF architecture, with a radio power-off feature; however it remains unclear how practical resource-constrained communications can be implemented, for example by using a serial protocol on top of the BT stack. Similarly [10] discuss a BT module approach with simple modifications to a TelosB gateway involving direct data forwarding to both the Universal Serial Bus (USB) port and the BT module. While the BT module can be placed in sniff mode, a possible limitation may be the considerable gateway power usage. Utilising the discussed BT power minimization and serial protocol, BT can be used for WSN sensor data or firmware upgrades. The solution described here involves a Roving Networks (RN-21) Bluetooth 2.0/EDR Class1 Module, combined with sensors for Carbon Monoxide (CO) and Volatile Organic Compounds (VOCs) amongst others. A sample GUI application was developed to display sensor data and to poll periodically for any available in-range discoverable connection requests from sensor networks. Consequently, Over-the-air upgrades of nodes is possible. Hybrid BT / ZigBee networks have been implemented albeit with limited support for pluggable low-power gateways. This solution represents a more realistic approach for remotely deployed networks where mains-powered gateways are not an option. Also, the pluggable nature allows optimal positioning of gateways for best mobile RF connectivity.

III. Conclusion

In this paper, the design and implementation of a mobile gateway for supporting remote interaction with WSN nodes has been described. Such a facility is essential for O&M operations in geographically disperse WSNs, and opens opportunities for new WSN-based services.

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REFERENCES