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ULTRA LOW-POWER WIRELESS

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***Abstract-* In this research paper, we have studied that university of arkanas engineering researchers has developed very low power wireless system that can grab data from remote sensors regardless of distortion along the network path. These distortions tolerant systems would enable sensors ,powered by batteries or energy harvesting,to remain in the fieldfor long periods of time and withstands rough conditions to monitor diverse things such as tunnel stability and animal health.the advantage of this is that by the tolerating distortions,the devices would expend less energy on trying to cleanup communications channels. But here the issue arises is that if we accept the fact that distortion is inevitable in practical communication systems, why not directly design a system that is naturally tolerant to distortion.**

***Index Terms-* sensors, distortions, communication, inevitable.**

I. INTRODUCTION

Wireless sensor networks are ideally suited for long-lived applications deployed at large densities for low cost. Unfortunately, the current WSN platforms built from commercial off-the-shelf (COTS) components have a lifetime of no more than two years, communicate through non-standard interfaces, are expensive, and are difficult to use for experimentation, development, testing, and deployment. In this paper, we introduce the design of Telos to further research in sensor networks with three major goals: lower power operation than previous mote generations, easy to use, and robustness for experimentation and deployment. The Telos design is based on the following low duty cycle principle: the node is asleep for the majority of the time, wakes up quickly on an event, processes, and returns to sleep. For the lowest power consumption, the standby current and wakeup time (time to transition from sleep to active mode) must be minimized [1] since the the active portion of a sensor network application is typically extremely small [2]. Telos offers more than just low power operation through its integrated design. Integration of programming, communication, storage, and sensing allows researchers to utilize more functionality and develop more robust systems.

II. RELATED WORK

The lineage of current platforms can be traced back to a number of devices called "COTS motes" built by the SmartDust projectand These devices were built to approximatethe capabilities of an envisioned SmartDust node with off the shelfcomponents [3]. These designs used a small 8-bit microcontrollers (4 to 8 kB of flash, 512 bytes of RAM); a simple radio (OOK modulationat 4kbps) and integrated sensors (magnetometers, accelerometers,temperature, pressure, etc). Later designs (weC [4], and Ren´e) exposed a custom sensor interface and allowed for the possibilityof remote reprogramming.Mica [5], released in 2001, was carefully designed to serve as a general purpose platform for WSN research. Compared withpreceding designs, it offered more memory (4kB of RAM and 128kB of flash), extensive sensor interfaces (8 analog lines, several digital IO channels, dedicated serial busses), and a very flexible radio interface. Mica used the RFM TR1000 and simple modulation techniques. The radio's primitive interfaces allowed low power operation and quick turn-on times. The unbuffered, bit-level radio interface connected to several IO pins, interrupts, and an SPI bus on the main microcontroller; the bus timing was controlled by the CPU clock. Researchers implemented a number of schemes for radio wakeup, low power asynchronous communications, fairly high bandwidth protocols (40 kHz physical layer), and precise time synchronization (to within a 1 bit time). Mica was useful for development, but unsuitable for deployments. The boost converter provided a stable voltage but used excess quiescent current. The radio communication range was short and relatively unreliable. The extensive I/O connector was not robust to variations in temperature [6]. Mica2, the follow on to the Mica platform, corrected many shortcomings: the boost converter was discarded, and the MCU was replaced with the ATmega128. This lowered the Mica2 standby current to about 17μA, while waking up the system takes up to 4 ms if using the external crystal. The radio transceiver was replaced with the Chipcon CC1000 offering tunable frequencies from 300 to 900 MHz and FSK modulation resilient to noise. The radio exposed a byte-level interface and timing interrupts. Although more resilient, the Mica2 had higher energy per bit and an order of magnitude higher wakeup time. Despite these shortcomings, Mica2 and the smaller Mica2Dot are the *de facto* standard research platforms in WSN research (16 of 21 papers in SenSys 2004 used Mica2 for evaluation). MicaZ [7] continues the evolution of the Mica family: it replaces the CC1000 radio with a CC2420, an IEEE 802.15.4 compatible radio. A single chip mote implementation called Spec [8] resulted from analyzing the Mica platform. The family of Berkeley motes preceeding Telos and their capabilities symbol detection, bit serialization, and encryption. Spec provides significant advantages in power consumption due to its integrated design and hardware accelerators. The Telos design parallels that of Spec– instead of integrating the design into silicon, Telos uses COTS components with hardware accelerators to build a power efficient system that does not sacrifice performance.

Integrated Design

Instead of using separate pluggable modules to create a full sensor node, Telos integrates programming, computation, communication, and sensing onto a single device. The integrated design provides an easy to use mote with increased robustness. Telos uses an internal 2.4GHz Planar Inverted Folded Antenna (PIFA) built into the printed circuit board and tuned to match the radio circuitry. always a fallback mechanism to a usable mote. The motivation for this design comes from the experience with real-world sensor networks on Great Duck Island (GDI) [10], [6]. On GDI, one of the main predictors of node failure was the existence of a failed sensor. Since the failure can be recognized in software, the ability to cut power to that section of the board may have saved the system as a whole. Since the IEEE 802.15.4 protocol has a 64-bit addressing scheme, we have included a 48-bit silicon serial identification chip. The id, combined with a manufacturer's IEEE Organizationally Unique Identifier (OUI) stored in write protected flash, provides the user with a valid, unique 64-bit MAC address. The MAC address is useful for system and network diagnostics, as well as absolute node identification.

Analysis

Our analysis of the Telos platform focuses on the platform's power consumption and the features that further research in sensor networks. The power consumption of a sensor module is not just the microcontroller and/or radio, but also the auxiliary components and their quiescent current. The power consumption of the Telos mote for various operations compared to the existing Mica2 and MicaZ platforms is shown Telos features a lower power flash and microcontroller than Mica2 (Atmel with CC1000 radio) and MicaZ (Atmel with CC2420 radio). Due to Telos' integrated design, 3μA additional current in sleep state is sacrificed to switches and buffers that protect current from flowing backward into disconnected components, specifically the USB circuitry. Despite this sacrifice, the overall power consumption of a sampling cycle (wakeup, sample, transmit, and sleep) is lower than existing platforms. The power consumption is the total time the mote is active multiplied by the current consumption during that time. Since Telos has lower current consumption, lower startup time, and lower operating voltage for the entire mote, it can achieve longer lifetimes than previous designs. At a 1% duty cycle, Telos can last for almost 3 years. For comparison, the lifetime of the Mica2 mote is 1.5 years and the MicaZ mote is 1 year [1]. Powerful microprocessor modules are now being integrated into embedded microcontrollers.

III. CONCLUSION

We have presented the design and implementation of Telos, the latest generation in a family of motes from UC Berkeley. We showed that Telos is the lowest power mote to date. Telos includes numerous enhancements that enable research in wireless sensor networks while making the devices easier to use and lowering the per-module cost. Other features, like hardware write protection and radio signal stability, closely map to current research. Researchers may experiment with the new IEEE 802.15.4 standard and use existing work in TinyOS. Additional flexibility allows software to configure or disable hardware modules. Telos is a robust module with lower power consumption yet greater performance than existing designs.

REFERENCES

[1] J. Polastre, R. Szewczyk, C. Sharp, and D. Culler, "The mote revolution:
Low power wireless sensor networks," in *Proceedings of the 16th Symposium on High Performance Chips (HotChips)*, Aug. 2004.
[2] V. Shnayder, M. Hempstead, B. rong Chen, G. Werner-Allen, , and
M. Welsh, "Simulating the power consumption of large-scale sensor
network applications," in *Proceedings of the Second ACM Conference on Embedded Networked Systems (SenSys)*, Nov. 2004.
[3] S. Hollar, "Cots dust," Master's thesis, University of California, Berkeley,
2000.
[4] J. McLurkin, "Algorithms for distributed sensor networks," Master's
thesis, University of California, Berkeley, 1999.
[5] J. Hill and D. Culler, "Mica: a wireless platform for deeply embedded
networks," *IEEE Micro*, vol. 22, no. 6, pp. 12–24, November/December
2002.
[6] R. Szewczyk, J. Polastre, A. Mainwaring, and D. Culler, "Lessons from
a sensor network expedition," in *Proceedings of the First European Workshop on Wireless Sensor Networks (EWSN)*, Jan. 2004.
[7] Crossbow Technology Inc., "MICAz wireless measurement system,"
http://www.xbow.com, June 2004.
[8] J. Hill, "System architecture for wireless sensor networks," Ph.D. dissertation,
University of California at Berkeley, 2003.
[9] P. Levis and D. Culler, "Mate: A tiny virtual machine for sensor
networks," in *Proceedings of the 10th International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)*, 2002.
[10] S. R. Madden, M. J. Franklin, J. M. Hellerstein, and W. Hong, "The
design of an acquisitional query processor for sensor networks," in
Proceedings of SIGMOD, June 2003.
[11] J. Polastre, "Interfacing Telos to 51-pin sensorboards," http://www.
tinyos.net/hardware/telos/telos-legacy-adapter.pdf, Oct. 2004.
[12] R. Szewczyk, A. Mainwaring, J. Polastre, and D. Culler, "An analysis
of a large scale habitat monitoring application," in *Proceedings of the Second ACM Conference on Embedded Networked Sensor Systems (SenSys)*, Nov. 2004.
(EWSN), Feb. 2005.