University of Pittsburgh

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Passively Powered, Low Power Microprocessor Controlled Camera

Value Proposition

The Passively Powered, Low Power Microprocessor Controlled Camera is a novel, low cost, system that integrates a currently available commodity camera chip, a simple, low power, microprocessor core that uses the Intel 8051 Instruction Set Architecture and RF energy harvesting circuitry which eliminates both the need for and the cost of additional power sources such as batteries or other power conversion circuitry. This system represents the first example of a broad family of passively powered, microprocessor controlled sensing systems enabled by these technologies.

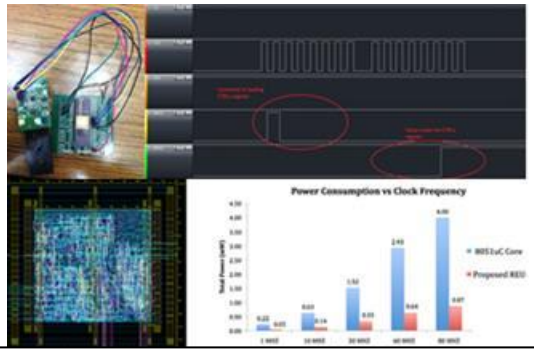
Market Opportunity

The primary market opportunity for this novel technology is centered on low power imaging or sensing applications where the integration of computing capability with sensors is necessary and where changing or charging batteries becomes a costly maintenance element. Yole Developpment, a market research firm, predicts a growing market for energy harvesting modules estimated at $45M in 2015 and growing to $227M in 2017 with building automation and industrial applications constituting the largest segment.

Future applications for this technology also include implanted medical devices such as pH sensors, Doppler blood flow monitors, and implantable cameras for monitoring specific internal sites where dependence on conventional battery power create clinical and maintenance issues.

Competitive Landscape

Energy Harvesting is currently an area of significant focus with much attention being paid to conversion of mechanical energy (due to vibration) and thermal energy (due to heat) given off by electric motors and other sources. Competition for a RF energy harvesting methods to passively power low power microprocessor based systems is limited.



Passively Powered, Low Power Microprocessor Controlled Camera

Technology

The Passively Powered, Low Power Microprocessor Controlled Camera integrates a currently available commodity camera chip, a simple, low power, microprocessor core that uses the Intel 8051 Instruction Set Architecture and RF energy harvesting circuitry which eliminates both the need for and the cost of additional power sources such as batteries or other power conversion circuitry. This system incorporates the best of all worlds, the programming flexibility of a microprocessor, the application potential f highly functional commodity devices like camera chips, and the energy harvesting capability of Application Specific Integrated Circuits (ASICs) such as those used in Radio Frequency Identification (RFID) tags.

Stage of Development

A Development Prototype has been constructed and Simulations are complete.

IP Status

Multiple patent applications related to this invention topic have been filed and are pending. Notice of Allowance for the first, primary patent has been received by the University of Pittsburgh

Funding

Funding to date has been entirely through University of Pittsburgh internal sources.

FEATURED INNOVATORS:

Innovator Names

Ziqun (Karen) Zhou, BSEE, Student in Electrical and Computer Engineering, **Vyasa Sai, MSEE, PhD,** Graduate Student in Electrical and Computer Engineering**, Ajay Ogirala, MSEE, PhD,** Graduate Student in Electrical and Computer Engineering**, Kara Nicole-Simms Bocan, BSEE/BioE,** Graduate Student in Electrical and Computer Engineering, **Joshua R. Stachel, BSEE, MSEE,** PhD Candidate in Electrical and Computer Engineering **Nicholas Griesmer Franconi, BSEE, MSEE,** Graduate Student in Electrical and Computer Engineering, **Ervin Sejdic, PhD,** Assistant Professor of Electrical and Computer Engineering, and **Marlin H. Mickle, BSEE, MSEE, PhD** Professor Emeritus of Electrical and Computer Engineering, Executive Director, RFID Center of Excellence

Publications

1. "Low-Power Data Driven Symbol Decoder for a UHF Passive RFID Tag", Vyasa Sai, Ajay Ogirala, and Marlin H. Mickle, ***Journal of Low Power Electronics***, Vol. 8, N° 1, December 2012, pp.58-62.

2. Vyasa Sai, Ajay Ogirala, and Marlin H. Mickle, "A Low-Power Pulse Width Coding Scheme for Communication Receiver Systems", ***ACTA Communications***, 2012.

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4. Vyasa Sai, Ajay Ogirala, and Marlin H. Mickle, "A Low Power Distributed Architecture Design Concept: FFT Processor", ***ACTA Communications***, 2012.

5. Vyasa Sai, Ajay Ogirala and Marlin H. Mickle, "Implementation of an Asynchronous Low-Power Small Area Passive Radio Frequency Identification Design Using Synchronous Tools for Automation Applications, ***Journal of Low Power Electronics***, Volume 8, No. 4, 2012, pp. 509-515.

Publications (con't)

6. Vyasa Sai, Ajay Ogirala and Marlin H. Mickle, "Low-Power Solutions for Wireless Passive Sensor Network Node Processor Architecture,", ***Chapter in Intelligent Sensor Networks: The Integration of Sensor Networks, Signal Processing and Machine Learning,"***, CRC Press, Dec. 15, 2012.

7. . Ervin Sejdic, Michael A. Rothfuss, Joshua R. Stachel, Nicholas G. Franconi, Kara Bocan, Michael R. Lovell and Marlin H. Mickle, Innovation and Translational Efforts in Wireless Medical Connectivity, Telemedicine and eMedicine: A Story from the RFID Center of Excellence at the University of Pittsburgh, ***Annals of Biomedical Engineering, The Journal of the Biomedical Engineering Society***, Special Coulter Edition, (2013) 41:1913-1925.

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10. Vyasa Sai and M.H. Mickle, "Exploring Energy Efficient Architectures in Passive Wireless Nodes for IoT Applications", ***IEEE Circuits and Systems Magazine***, Vol.14, no 2, pp.48-54, 2nd quarter 2014.

11. Vyasa Sai and Marlin H. Mickle, "Low power 8051-MISA-based remote execution unit architecture for IoT and RFID applications", ***Int. J. Circuits and Architecture Design***, Vol. 1, No. 1, 2013, pp. 4 – 19.

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