A Design of Smart Energy Harvesting System with Efficient Power-Point Tracking for Wireless Sensor Networks

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***Abstract* - Wireless sensor networks (WSNs) are envisioned to have a significant impact for many applications such as health monitoring and area surveillance. Since many advances in energy aware communication techniques for WSNs, so limitation for energy supply is still a critical issue. One of the most attractive approaches to extend the lifetime of WSNs is harvesting energy from the ambient sources, such as solar, wind and vibration and the dynamic and these sources give rise to many new challenges to modeling and of harvested energy as well as the examination of energy harvesting systems.**

Sensor networks aim to address energy and by focusing and efficient energy harvesting, usage and delivery. Power management for WSNs mostly focuses on renewable energy harvesting methods that utilize minimal maintenance. hence this project explored a possible next step for WSN energy gathering: a self-starting DC-DC resonant converter that transfers energy from a thermo-electric energy harvester to the load. The fullness feature of its self-starting circuit enabled it to start operating at lower voltages ranging from 400-625 mV to produce a 1 V regulated output. It also specify a maximum power point tracking circuit to ensure maximum power transfer. Moreover, it was fully integrated using a 65 nm CMOS process technology resulting in an area of 863 um by 706 um and 771.85 uW power consumption.

I.INTRODUCTION

Wireless sensor networks are typically self-organizing and self-healing with a distributed control architecture. In other words, sensor nodes are able to join-in or leave a network easily without affecting other nodes. This self-organization feature creates a possibility for the scalable deployment of a large number of sensors over a wide geographical area. Moreover, the decentralized network management provides a scalable and robust performance with respect to node failures. With these advanced features, WSNs are broadly used in numerous industrial and civilian applications, such as agriculture automation [3], structural security [4, 5], environmental monitoring [6], and area surveillance [7, 8]. In particular, WSNs are extremely useful for emergency response [9] and disaster relief operations [10] when no infrastructure of traditional wireless network is available. For example, sensor nodes are deployed in an area hit by disaster(e.g., earthquake), and report sensed information, e.g., temperature, to derive a "map" of safe / dangerous areas within building, grounds, etc. for disaster relief operation.

II. OBJECTIVES

The main objective of the respective project work is given below.

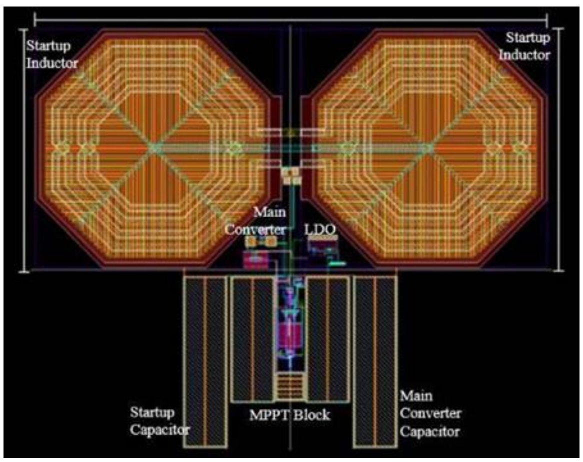
- A depth review of the existing research of WSN and thermal energy will be performed to know the bench marking issues in it.
- In order to overcome the existing issues in IoT based thermal energy models, the existing research is considered for performance comparison.
- This project explored a possible next step for WSN energy harvesting: a self-starting DC-DC resonant converter that transfers energy from a thermo-electric energy harvester to the load.

III. METHODOLOGY

Energy Harvesting (EH) also referred as power harvesting or energy scavenging. In this process, energy is derived from other external sources, captured and restored in microelectronic devices or wireless sensor devices. EH provide a little amount of energy for low power electronics which could be utilized for future purpose. However, in this scheme, the system converts the energy (like kinetic energy, thermal energy or solar energy) into electrical energy which is captured form different energy sources. Thus, researchers found the different energy harvesting technologies which is discussing in the following section.

IV RESULTS AND DISCUSSIONS

This project implements an interface circuit for a thermo-electric energy harvester, with resonant self-starting and maximum power point tracking capabilities, for input varying from 410 mV - 615 mV. The harvested energy will store in a1nF capacitor and the output voltage will regulate at 1 V.t. We have performed simulations using custom written MATLABTM code.



Integrated System Layout

V CONCLIUSION

Conclusions are drawn based on the results obtained from experimental and characteristic analysis of proposed system.

This project implemented an interface circuit for a thermo-electric energy harvester, with resonant self-starting and maximum power point tracking capabilities, for input varying from 410 mV - 615 mV. The harvested energy was stored in a 1nF capacitor and the output voltage was regulated at 1 V. The power consumption of whole system was 771.85 ȝW and the chip area was 863 ȝm by 706 ȝm.

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