Integrated Wireless Multi-Core Engineering Wireless Sensor Networks and Applications

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ABSTRACT: *Technological advancements in the silicon industry, as predicted by Moore's law, have enabled integration of billions of transistors on a single chip. To exploit this high transistor density for high performance, embedded systems are undergoing a transition from single core to multi-core. Although a majority of embedded wireless sensor networks (EWSNs) consist of single-core embedded sensor nodes, multi-core embedded sensor nodes are envisioned to burgeon in selected application domains that require complex in-network processing of the sensed data. In this project, an architecture for heterogeneous hierarchical multi-core embedded wireless sensor networks (MCEWSNs) as well as an architecture for multi-core embedded sensor nodes used in MCEWSNs is proposed.. This project also investigates the feasibility of two multi-core architectural paradigms symmetric multiprocessors (SMPs) and tiled many-core architectures (TMAs)V for MCEWSNs. This work compares and analyzes the performance of an SMP (an Intel-based SMP) and a TMA (Tilera's TILEPro64) based on a parallelized information fusion application for various performance metrics (e.g., runtime, speedup, efficiency, cost, and performance per watt). Results reveal that TMAs exploit data locality effectively and are more suitable for MCEWSN applications that require integer manipulation of sensor data, such as information fusion, and have little or no communication between the parallelized tasks. To demonstrate the practical relevance of MCEWSNs, this project also discusses several state-of-the-art multi-core embedded sensor node prototypes developed in academia and industry.*

INTRODUCTION:

An integral part of wireless sensor networks (EWSNs) comprising Contract sensor with integrated sensor to detect The data on the phenomenon, and these sensor nodes Communicate with adjacent nodes in the sensor And the wireless connections. Many emerging EWSN applications (for example, Control and monitoring of the volcano) require an abundance Sensors (eg acoustics, seismic, temperature, and, Recently, image sensors and / or smart cameras) An integral part of the sensor contract. Although traditional EWSNs equipped with numeric sensor

(eg temperature, Humidity) transfer of most of the information to play Receiver node (base station node), this sense of transmission of The model has become a viable hunger information Applications equipped with a broad range of sensors, Including image sensor devices and / or smart cameras. Treatment and transfer of a large amount Data per detection in emerging applications EWSNs traditional capabilities. For example, Consider EWSN deployed on the army battlefield, what requires different sensors, such as cameras, Acoustics, and electromagnetic detection devices? This application presents

different challenges for the list since EWSNs Transferring high resolution video images more streams limit wireless bandwidth Sensor node carried out is the glory of the pool. On the other hand, the value of data and multimedia processing (audio, Photos and videos in this example) in real time beyond EWSNs conventional capabilities, which include Unipolar embedded sensor nodes [1] [2], and requires The strongest embedded sensor nodes to achieve this Positivism. Since EWSNs ground core soon will be able to Meeting the growing needs of information rich Applications (eg, video sensor networks), near the generation of sensor nodes must be able to strengthen the capacities of computer science and communications. For the whole For example, the first generation transfer rate Mika distribution was 38.4 kilobytes per second, while the second the distribution of the Mika generation (MicaZ distribution) can be communicated At 250 kbps using the IEEE 802.15.4 (Sieg PE) [3]. In spite of these developments in the field of telecommunications, wireless limited the bandwidth of the sensor nodes sinks node tags Timely transfer of multimedia data to an output node It's not possible. In traditional EWSNs, and communication Energy dominates the energy bill. For example, Sensor node is an integral part of that produced by Rockwell Automation [4] 2000X to spend more energy for Transfer a little of that to implement a Instructions for [5]. Similarly, the transmission of 15 frames in the second (FPS) of digital video streams over a wireless network Bluetooth link takes 400 MW [6]. Fortunately, there is no correlation between Transfer and EWSN account, which is well adapted to the information rich transformation of the network Applications and allows single event transfer Description (eg, detection of the target of

interest) they sink into knots to conserve energy. Technological Progress in multi-core architectures Multicore viable and cost effective option to increase the calculation capacity is an integral part of The sensor nodes. Multinoreal is an integral part of sensor contract can Extract required information from remote sensing data and communicate all this information is processed, this reduces the amount of data transferred to the sink Do not give. By replacing a large proportion of communications with an account in the network, and embedded multi-core Sensor can achieve substantial energy savings that would be a total over the age of the sensor network. Multicore is an integral part of the sensor allows energy Savings compared to traditional single-core embedded sensors The contract in two ways. For the first time, reducing the energy expended In the field of telecommunications through the realization in situ of account Data per detection and will forward the single processed Information. Second, the embedded multi-core node sensor It allows accounts to split into multiple cores While each processor core operates at lower voltage and the frequency, compared to the single core system, Giving rise to an energy saving. The main aim of the project is to design and implementation of a complete WSN platform that can be used for a range of long-term environmental monitoring IoT applications. In olden days, the Internet of Things (IoT) paradigm was coined in which computers were able to access data about objects and environment with human interaction. It was aimed to complement human-entered data that was seen as a limiting factor to acquisition accuracy, pervasiveness and cost. So it is a main disadvantage of an existing method. The disadvantage of the existing method can

overcome by Two technologies were traditionally considered key enablers for the IoT paradigm: While the former is well established for low-cost identification and tracking WSNs bring IoT applications richer capabilities for both sensing and actuation. The application requirements for low cost, high number of sensors, fast deployment, long lifetime, low maintenance, and high quality of service are considered in the specification and design of the platform and of all its components. In fact, WSN solutions already cover a very broad range of applications, and research and technology advances continuously expand their application field. This trend also increases their use in IoT applications for versatile low-cost data acquisition and actuation. In this project have two sections. Section1 (block diagram) have sensors and Zigbee. In this the status of the sensors and transmitted to the section 2 using Zigbee wireless communication. Section2 will receive the information and upload it into internet server using GPRS. The system uses a compact circuitry built around LPC2148 (ARM7) microcontroller Programs are developed in Embedded C. Flash magic is used for loading programs into Microcontroller.

LITERATURE REVIEW:

In article [1], The availability of low-cost hardware is enabling the development of wireless multimedia sensor networks (WMSNs), i.e., networks of resource-constrained wireless devices that can retrieve multimedia content such as video and audio streams, still images, and scalar sensor data from the environment. In this paper, ongoing research on prototypes of multimedia sensors and their integration into test beds for experimental evaluation of algorithms

and protocols for WMSNs are described. Furthermore, open research issues and future research directions, both at the device level and at the test bed level, are discussed. This project is intended to be a resource for researchers interested in advancing the state-of-the-art in experimental research on wireless multimedia sensor networks.

In the [2], Wireless sensor networks (WSN), an element of pervasive computing, are presently being used on a large scale to monitor real-time environmental status. However these sensors operate under extreme energy constraints and are designed by keeping an application in mind. Designing a new wireless sensor node is extremely challenging task and involves assessing a number of different parameters required by the target application, which includes range, antenna type, target technology, components, memory, storage, power, life time, security, computational capability, communication technology, power, size, programming interface and applications. This paper analyses commercially (and research prototypes) available wireless sensor nodes based on these parameters and outlines research directions in this area.

The author [3], Conventional wireless sensor networks rely mostly on simple scalar data (such as temperature or humidity) and specialize in single-purpose applications. Taking a fundamental departure, in this work motivate information-rich wireless video sensor networks that emulate the compound eyes found in certain arthropods. Although constrained by scarce resources, sensor nodes can only serve extremely low-resolution video streams; the availability of vast amount of such streams due to deployment redundancy can suffice for the need of information hungry applications. Unfortunately,

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the unique characteristics of wireless video sensor networks will introduce novel uncertainty-driven challenges in the information-intensive and yet resource-constrained environment. Correspondingly,

In the article [4], a wireless sensor network, each node is power-constrained and may need to acquire some raw data of large size (e.g., image data), on which some computation-intensive tasks (e.g., edge detection) will be done. On the other hand, in wireless communication, significant power will be consumed on transferring a sequence of data of large size. Thus, it is of high interest to carry out the sensor nodes' computation-intensive tasks efficiently while reducing the data size for wireless transfer. In this paper, we propose a new design methodology for batch processing of image data in a wireless sensor network, by employing re-configurable computing using FPGAs.

The author [5], With Moore's law supplying billions of transistors on-chip, embedded systems are undergoing a transition from single-core to multi-core to exploit this high transistor density for high performance. However, there exists a plethora of multi-core architectures and the suitability of these multi-core architectures for different embedded domains (e.g., distributed, real-time, reliability-constrained) requires investigation. Despite the diversity of embedded domains, one of the critical applications in many embedded domains (especially distributed embedded domains) is information fusion. Furthermore, many other applications consist of various kernels, such as Gaussian elimination (used in network coding), that dominate the execution time. In this paper, we evaluate two embedded systems multi-core architectural paradigms: symmetric multiprocessors (SMPs) and tiled multi-core architectures (TMAs). We base our evaluation on a parallelized information fusion application and benchmarks that are used as building blocks in applications for SMPs and TMAs. We compare and analyze the performance of an Intel-based SMP and Tilera's TILEPro64 TMA based on our parallelized benchmarks for the following performance metrics: runtime, speedup, efficiency, cost, scalability, and performance per watt. Results reveal that TMAs are more suitable for applications requiring integer manipulation of data with little communication between the parallelized tasks (e.g., information fusion) whereas SMPs are more suitable for applications with floating point computations and a large amount of communication between processor cores.

In article [6], study presents a single-core and a multi-core processor architecture for health monitoring systems where slow bio signal events and highly parallel computations exist. The single-core architecture is composed of a processing core (PC), an instruction memory (IM) and a data memory (DM), while the multi-core architecture consists of PCs, individual IMs for each core, a shared DM and an interconnection crossbar between the cores and the DM. These architectures are compared with respect to power vs performance trade-offs for a multi-lead electrocardiogram signal conditioning application exploiting near threshold computing. The results show that the multi-core solution consumes 66% less power for high computation requirements (50.1 MOps/s), whereas 10.4% more power for low computation needs (681 kOps/s).

In article [7], this work describes two methodologies for performing distributed particle filtering in a sensor network. It considers the

scenario in which a set of sensor nodes make multiple, noisy measurements of an underlying, time-varying state that describes the monitored system. The goal of the proposed algorithms is to perform on-line, distributed estimation of the current state at multiple sensor nodes, whilst attempting to minimize communication overhead. The first algorithm relies on likelihood factorization and the training of parametric models to approximate the likelihood factors. The second algorithm adds a predictive scalar quantizer training step into the more standard particle filtering framework, allowing adaptive encoding of the measurements. As its primary example, this work describes the application of the quantization-based algorithm to tracking a manoeuvring object. This project concludes with a discussion of the limitations of the presented technique and an indication of future avenues for enhancement.

In article [8] , Advancement in computing technology has led to the production of wireless sensors capable of observing and reporting various real world phenomena in a time sensitive manner. However such systems suffer from bandwidth, energy and throughput constraints which limit the amount of information transfer from end-to-end. Data aggregation is a known technique addressed to alleviate these problems but are limited due to their lack of adaptation to dynamic network topologies and unpredictable traffic patterns. In this project, we propose three novel data aggregation schemes; in-network data aggregation, grid-based data aggregation and hybrid data aggregation, which increases throughput, decreases congestion and saves energy. Our simulation results show that the end-to-end transmission delay is reduced by a factor of 2.3, the throughput increases by a factor of 2.4 under heavy load conditions and the energy

dissipated is reduced by a factor of 2.2. He conclude the the evaluation by proposing an hybrid aggregation scheme through which sensor nodes can dynamically change from one aggregation technique to the other in an unpredictable environment and adapt to dynamic changes in the network.

CONCLUSION:

In this project, an architecture for heterogeneous hierarchical multi-core embedded wireless sensor networks (MCEWSNs) is implemented Compute-intensive tasks such a information fusion, encryption, network coding, and software defined radio, will benefit in particular from the increased computational power offered by multi-core embedded sensor nodes. Many wireless sensor networking application domains, such as wireless video sensor networks, wireless multimedia sensor networks, satellite based sensor networks, space shuttle sensor networks, aerial-terrestrial hybrid sensor networks, and fault-tolerant sensor networks, can benefit from MCEWSNs. Perceiving the potential benefits of MCEWSNs, several initiatives have been undertaken in both academia and industry to develop multi-core embedded sensor nodes, such as Intra Node, satellite-based sensor nodes, and smart camera motes. This project evaluated two multi-core architectures, symmetric multiprocessors (SMPs) and tiled many-core architectures (TMAs), for multi-core embedded sensor nodes in an MCEWSN based on a parallelized information fusion application. Results revealed that the TILEPro64 exhibited better scalability and attained better performance per watt than the SMPs for the information fusion application. Specifically, MCEWSNs would benefit from advancements in application parallelization, signal processing, computer-vision, re configurability, energy harvesting, near

threshold computing, heterogeneous architectures, and transistor technology

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