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Design And Analysis Of Wireless Sensor Networks(WSN) For Multi-Core Processor Of Internet Of Thongs (IoT)

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ABSTRACT : The Wireless sensor networks (WSNs) For Internet of Things (IoT) have become an advanced concept to research in environment of IoT for Multi-core processor based WSN. The proposal of system is to develop a sensor interface device which is essential for sense the Environmental data collection of industrial Wireless Sensor Networks (WSN) in Internet of Things (IoT).A wireless smart sensor platform targeted for instrumentation and predictive maintenance systems is presented. Hence to measure the status and process parameters like Temperature, and Light Insensitivity, present in the environment, there is requirement of intelligent system with wireless networking. A new method is proposed and designed for WSN in IoT environment In the Multi-core, It is designed and developed in such a way that a sensor interface device for WSN in IoT atmosphere, in which an Advanced Reduced Instruction Set Machine (ARM-9 FL2440) is adopted as the core has used. Performance of the proposed system is verified and good effects are achieved in practical application of IoT. Thus, it will scan information in parallel and in real time with high speed on multiple completely different device information. Intelligent device interface specification is adopted. IoT is the concept to Operate and check status from anywhere by just using Internet and we can control the parameters by Manually or Automatically by just changing mode. Zigbee is used as Wireless Sensor device at both ends for transferring the data from one to other. These signals are conditioned and displayed in LCD display. So that critical situation can be avoided and preventive measures are successfully implemented. Wireless sensor network is one of the Pervasive networks. Internet of Things (IoT) has attracted a lot of attention and is expected to bring benefits to numerous application areas including industrial WSN systems, and healthcare systems, environmental monitoring in IoT Environment.

Keywords : *Wireless Sensor Networks,IoT,Arm-9 Fl2440,Multi-core Processor.*

I. INTRODUCTION

A wireless sensor network (WSN) is a distributed autonomous sensor's to monitor physical and also environmental conditions, such as Temperature, Pressure, Flow, Level, Gas etc. and to cooperatively pass their data through the network to a main location. The more modern networks are bidirectional, also enabling control of sensor activity. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, condition monitoring of machines, and so on. Provide a bridge between the real physical and virtual worlds. Allow the ability to observe the previously unobservable at a fine resolution over large spatiotemporal scales. Have a wide range of potential applications to industry, science, transportation, civil infrastructure, and security. The WSN is built of "nodes" – from a few to several hundreds or even thousands, where each node is connected to one (or sometimes several) sensors. Each such sensor network node has typically several parts: a transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvesting. The topology of the WSNs can vary from a simple star network to an advanced multi-hop wireless mesh network, Reconfigurable smart sensor interface device that integrates data collection data processing, and wired or wireless transmission. The device can be widely used in many application areas of the IOT and WSN to collect various kinds of sensor data in real time. The overall structure of reconfigurable smart sensor interface consists of ARM 9-FL2440 32-bit multi-core. The propagation technique between the hops of the network can be routing or flooding. First of all, microcontroller is used as the core controller to release the restriction on the universal data acquisition interface, and realize truly parallel acquisition of sensor data. It has not only improved the sensor data collection efficiency of industrial WSN, but also extended the application range of the data acquisition. Secondly, a new design method sensor nodes to the sink node is infeasible. Furthermore, meaningful processing of multimedia data (acoustic, image, and video in this example) in real-time exceeds the capabilities of traditional EWSNs consisting of single-core embedded sensor nodes ,and requires more powerful embedded sensor nodes to realize this application. Since single-core EWSNs will soon be unable to meet the increasing requirements of information-rich applications (e.g., Temperature, Light Sensor), next generation sensor nodes must possess enhanced computation and communication capabilities. For example, the transmission rate for the first generation Mica motes was 38.4 kbps whereas the second generation Mica motes (MicaZ motes) can communicate at 250 kbps using IEEE 802.15.4 (Zigbee) . Despite these advances in communication, limited wireless bandwidth from sensor nodes to the sink node makes timely transmission of multimedia data to the sink node infeasible. In traditional EWSNs, the communication energy dominates the computation energy.

II. MULTI-CORE ARCHITECTURE OF WSN

To implement the design and implementation of multi-core embedded system with wireless sensor network for the fault location or the monitoring machines and these machines work in a ideal and running condition. And multi core embedded system state that more than one controller is required for the cluster means here require three microcontroller for the critical cluster, non critical cluster and Communicate with the server. And these controllers work independently as per the requirement long lifetime WSN node powered by standard battery, currently an ultralow power single core (8, 16 or 32,64-bit) is used. However this implementation solved partially energy consumption problem but it still not meet WSN node robustness requirement.

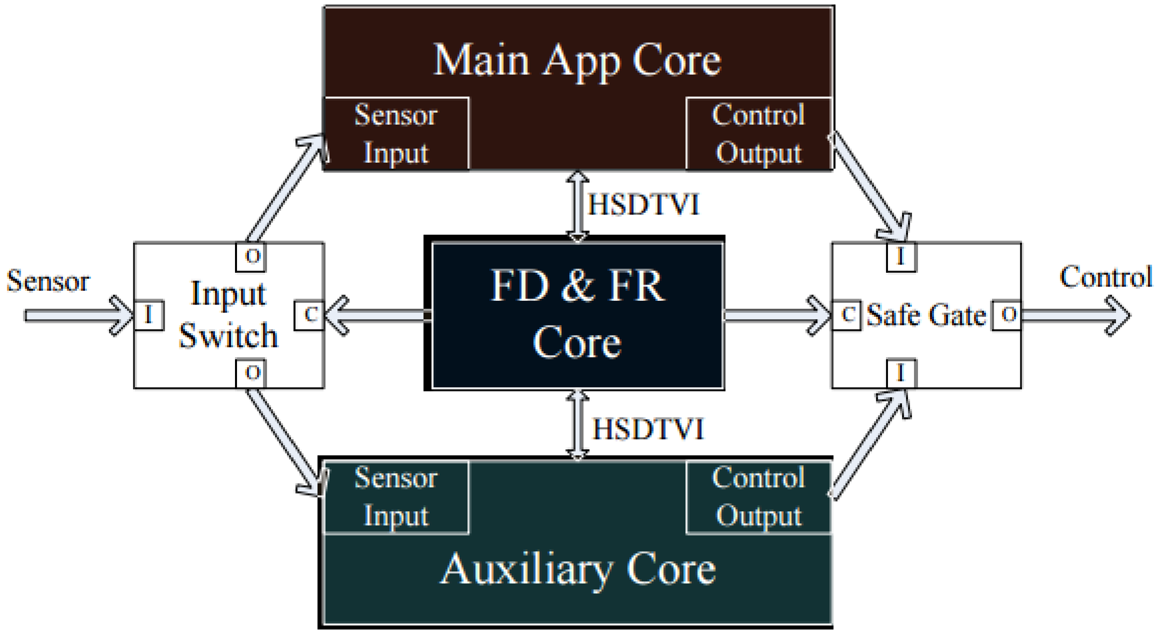


Figure 1: Block diagram of WSN Multicore Architecture

In Fig-1 the presents in block diagram of multi-core architecture. There are three types of cores in the node. The Main App Core is a normal application core as same as in single core WSN node. The Auxiliary Core is optional core; the function of this core is depended on specific¬ application. The FD& FR Core is the key component in the multicore architecture. It coordinates all components in the nodes, runs as a monitor of Main App Core, detects faults in the Main App Core. It will isolate the faulty Main App Core and active the Auxiliary Core to substitute the Main App Core if necessary. Through the switching of core, multicore WSN node can provide seamless services even in the presence of faults. The Input Switch and Safe Gate are controlled by the FD & FR Core. So FD & FR Core can isolate the fault Core from Sensor Input and Control Output. This can greatly help to achieve a functional safety system. My work focused on the research and development of a new WSN node architecture aiming to increase at the same time the WSN node lifetime, modularity and robustness. If we can achieve these objectives the new WSN node will meet the requirements of high constraint indoor (smart care e.g.) and outdoor (precision agriculture e.g.)

III. DESIGN AND IMPLEMENTATION OF MULTI-CORE IOT

The design of the Multi-core Processor is the "brain" for IoT systems ,Small space but increasing processing demand ,e.g., intelligent control, various data processing , Achieving ultra low-power multi-core processors. Utilizing flexibility enabled by granularity in core numbers ,Power/energy proportional to computation load.

A. GATEWAY

To measure the Temperature and Light of the USB Gateway Module (SNGW) is the bridge between SENSE nuts' IEEE 802.15.4 network and the User Interface. It enables the programming of Radio Module and display data coming from the network on a Personal Computer. When connected with Radio Module, it powers other modules so as to disconnect the battery when the device is connected with the Gateway.

Gateway Module is connected with a computer by a USB Mini cable which comes along with the package. It is a part of the modular system and no special arrangement is needed to connect the same with other modules. Two 40-pin connectors on the board enables a designer to connect the Gateway Module with other modules. Some of the features of the module are mentioned below.

- USB to asynchronous serial data transfer interface
- USB protocol handled by the module, so no USB specific programming required to control the communication
- Data transfer rate at 115200 baud
- 128 byte receive and 256 byte transmit buffer for faster communication

B. SENSOR TL

The Sensor module is a part of SENSE nuts development platform, which comprises of a temperature and a light sensor. Both the temperature and light sensors are accessed from I2C port of Radio Module. This configuration enables the communication between the Radio and the Sensor Module with minimal use of Pins on Radio, leaving enough pins on the Radio Module to be used for other purpose.

The temperature sensor on the module is a 12-bit resolution digital sensor, which can detect a temperature change of as low as 0.0625°C. The sensor is capable of generating software independent interrupts, which when connected to a DIO can be used to wake the sensor from sleep, or report the microcontroller whenever a threshold is crossed.

The Ambient light sensor, with its 16-bit resolution and an excellent UV/IR rejection is capable of working at an extremely low power. Similar to temperature sensor, the light sensor is capable of generating software independent interrupts to update the microcontroller about a critical event.

Applications:

The module is suitable for a wide variety of applications involving temperature and light intensity measurements. Few of them are highlighted below:

- General temperature measurements
- Home automation
- Industrial and medical light sensing
- Precision agriculture

The Implementation of the architecture of simulation programs As it was explained, the meta-simulator environment is a higher level modeling allowing to produce and manage networks instances. Practically, models are described and produced from Smalltalk-80, and the simulations described in this article are all produced in Occam. The core model is an object data structure with links and nodes that represent communication channels and sensors. Each node has a name (such as P1 or P2), and an associated program known as a symbol (Node, Node Zero). This symbol is used to bind to a coded behavior (Occam procedure). The list within braces is the connectivity of the named process.

1) P1 { P2 , P3 , P4 } Node
2) P2 { P1 , P3 } Node
3) P4 { P1 } Node
4) P3 { P1 , P2 } Node Zero
5) P5 { P6 } Node
6) P6 { P5 } Node
7) The structural description shown above is graphically represented in Figure 2.

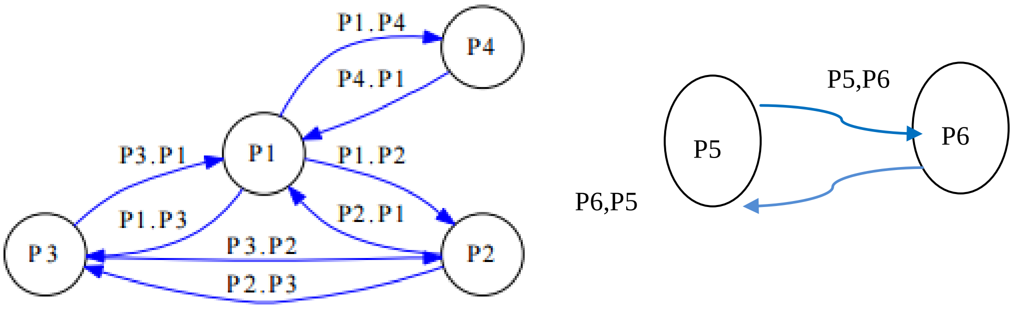


Figure 2.Multicore System Into Dual-Core

Current sensor networks are usually stationary, although sensors may be attached to moving objects or may even be capable of independent movement. These characteristics: being embedded, and being capable of sensing, actuation, and the ability to communicate, define the field of sensor networking and differentiate it from remote sensing, mobile computing with laptop computers, and traditional centralized sensing systems. As of 2004, sensor networking is a very active research area with well-established hardware platforms, a growing body of software, and increasing commercial interest. Sensor networks are seeing broader research and commercial deployments in military, scientific, and commercial applications including monitoring of biological habitats, agriculture, and industrial processes.

IV. HARDWARE DETAILS

One major challenge in a WSN is to produce *low cost* and *tiny* sensor nodes. There are an increasing number of small companies producing WSN hardware and the commercial situation can be compared to home computing in the 1970s. Many of the nodes are still in the research and development stage, particularly their software. Also inherent to sensor network adoption is the use of very low power methods for radio communication and data acquisition.

ARM 9-FL2440 Based Multi-Core Processor

The ARM FL2440 processor is the industry-leading 64-bit processor for highly deterministic real-time applications, specifically developed to enable partners to develop high performance low-cost platforms for a broad range of devices including microcontrollers, automotive body systems, industrial control systems and wireless networking and sensors. The processor delivers outstanding computational performance and exceptional system response to events while meeting the challenges of low dynamic and static power constraints. The processor is highly configurable enabling a wide range of implementations from those requiring memory protection and powerful trace technology to cost sensitive devices requiring minimal area (ARM Ltd., 2013). The ARM based microcontroller becomes more and more popular in wireless networking field. Even though we did not use it in this dissertation, I think we will use it in next design.

Key Features The major features of the MWSN are listed below: Ultra-low power consumption, Dimension 85mm*54m , light sensor, temperature sensor , air humidity sensor , Passive Infrared Motion Detector, Decagon soil moisture sensors, RS232 ports, USB slave port,Real-time Clock (RTC),SD Card,IEEE802.15.4 ZigBee wireless access medium.

C. SOFTWARE REQUIREMENTS

The Linux Operating System: Linux or GNU/Linux is a free and open source software operating system for computers. The operating system is a collection of the basic instructions that tell the electronic parts of the computer what to do and how to work. Free and open source software (FOSS) means that everyone has the freedom to use it, see how it works, and changes it.There is a lot of software for Linux, and since Linux is free software it means that none of the software will put any license restrictions on users. This is one of the reasons why many people like to use Linux it has shown in the Fig 3.

Fig3. Architecture of Linux ARM 9 Processor

A Linux-based system is a modular Unix-like operating system. It derives much of its basic design from principles established in UNIX during the 1970s and 1980s. Such a system uses a monolithic kernel, the Linux kernel, which handles process control, networking, and peripheral and file system access. Device drivers are either integrated directly with the kernel or added as modules loaded while the system is running.

V. EXPERIMENTAL RESULTS & DISCUSSION

In this section, we first evaluate the parallelized developed for the multi-core processors on the ARM-9, we simply translate the previous approach to the SIMD instruction. Then, we compare the multiplication methods which are table-based ,loop-based, SIMD instruction set multiplication. Further ,we compare parallelized decoding performance of applying the multiplication methods temperature and Light sense on the results of the shown in the fig 4. We also evaluate partitioning workload applying the three multiplication methods adaptively, using multiple factor. Finally, we evaluate our parallelized progressive decoding method on the ARM-9and we compare it to the commercially available homogeneous multi-core systems. as shown in the Table 1,2.

Figure 4 :Sensor IoT in Gateway And Temperature And Light Sensors

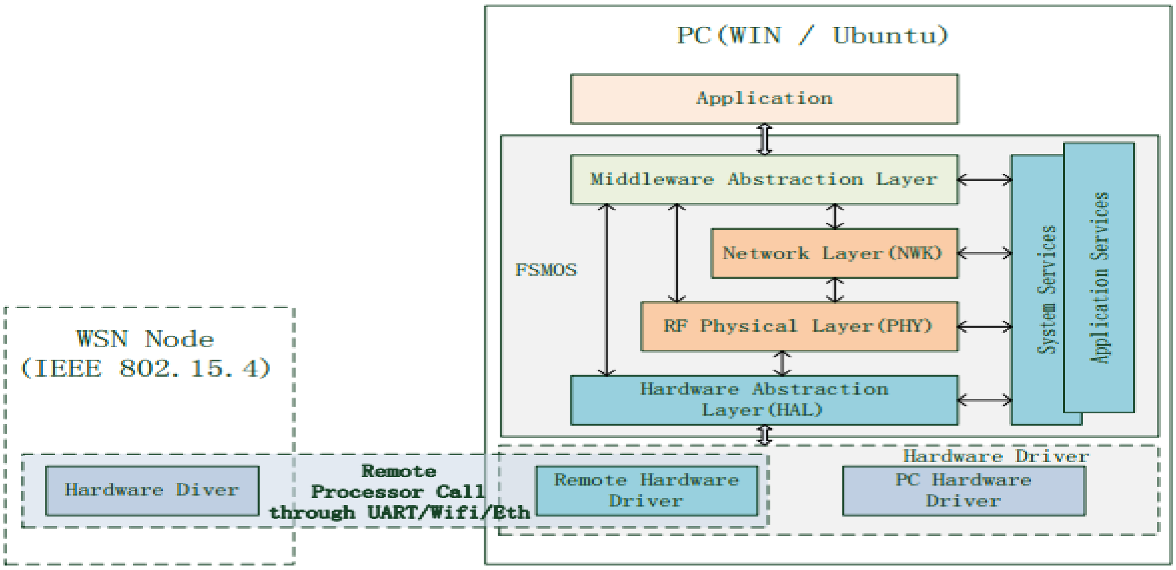


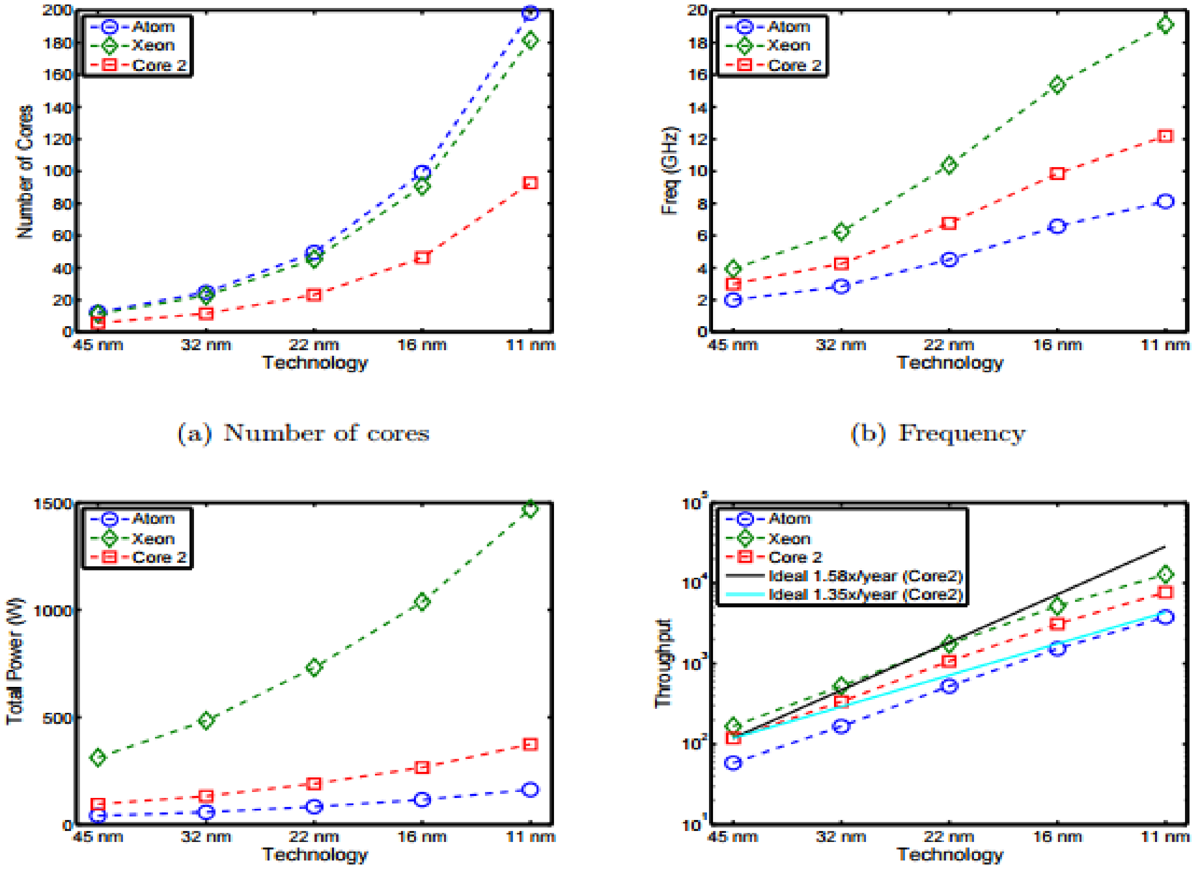
Figure 5 : Architectural Module Of WSN Based IoT In Multi-Core

Table-1 Single-Core Based IoT IN the WSNs

Talk	Power	Time Used	Energy Consumption
Sensing	15.9mA	900ms	42795
Signal Processing	9.9mA	268ms	7919
Wireless Communication	21.8mA	140ms	9156
		Total	59870

Table-2 Multi- Core Based IoT IN the WSNs

Task	Power	Time Used	Energy Consumption
Sensing	12.4mA	724ms	35495
Signal Processing	6.8mA	205ms	7051
Wireless Communication	17.3mA	92ms	8351
	Total		50897



(a) Number of cores

(b) Frequency

(c) Power

(d) Throughput

Figure 6.Output Graphs of Various Cores Used and Power And Performance

VI. CONCLUSION

Multi-Core Embedded Wireless Sensor Networks for IoT Architecture and Applications has been successfully designed and tested. It has been developed by integrating features of all the hardware components and software used. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit and measured the temperature and lighe availability, Secondly, using highly advanced ARM board and with the help of growing technology the project has been design a 2 core system successfully implemented. These are the part of a huge fault diagnostic system. They have independent and are partially autonomous. We have developed GUI software in visual basic to control and monitor the industries. The system is working successfully and detecting time and power consumption. In future the System is expandable and scalable i.e. More sensors can be added to each cluster.

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