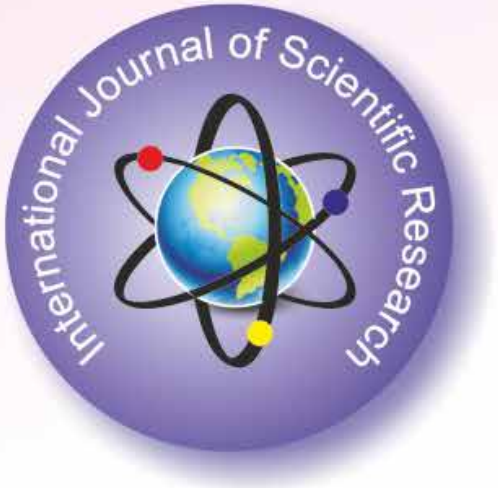
International Journal of Scientific Research

Indexed with International ISSN Directory, Paris

Volume 1 | Issue 3 | August 2012



ISSN No. 2277 – 8179

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ISSN No. 2277 – 8179

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Volume : 1 | Issue : 3 | Aug 2012 • ISSN No 2277 - 8179

Research Paper

Engineering

KEYWORDS :

Energy Optimization And Power Scheduling In Low Power Sensor Network

Prof.MS.Vaishali R	Sonawane,Sinhgad Institute of Technology, Lonavala
Prof.D.K.shende	Sinhgad Institute of Technology, Lonavala.
Prof. MS. Shubhangi	Sonawave, MIT ACSC,Alandi,Pune

ABSTRACT

A wireless sensor network (WSN) is consisting of spatially distributed autonomous devices using sensors to co-operatively monitor physical or environmental conditions such as ,temperature ,sound ,vibration ,pressure ,motion or pollutants at different locations .WSN consists of one or more sensors, each node in a sensor network is typically equipped with a radio transceiver or other wireless communication device, a microcontroller and an energy source usually a battery . It communicates with a base station which is the data receiving hub with capacities of storage and basic data analysis In wireless sensor networks (WSNs), long lifetime requirement of Different applications and limited energy storage capability of sensor nodes has led us to find out new horizons for reducing power consumption upon nodes..A critical issue in a wireless sensor networks is power scarcity driven in part by battery size and weight limitations . Energy is the scarcest resource of WSN nodes and it determines the lifetime of WSN 's

1. INTRODUCTION

A wireless sensor network (WSN) is consisting of spatially distributed autonomous devices using sensors to co-operatively monitor physical or environmental conditions such as ,temperature ,sound ,vibration ,pressure ,motion or pollutants at different locations .

To realize this opportunity, information technology must address a new collection of challenges. The individual devices in a wireless sensor network (WSN) are inherently resource constrained: They have limited processing speed, storage capacity, and communication bandwidth. These devices have substantial processing capability in the aggregate, but not individually, so we must combine their many advantage points on the physical phenomena within the network itself.WSNs to realize ambient intelligence, which is a vision through which environment becomes smart, friendly, context-aware, and responsive to human needs. A WSN is a network composed of sensor nodes in a sensor field to cooperatively monitor physical or environmental conditions such as temperature, humidity,vibration, or pressure.

The challenges in the hierarchy of: detecting the relevant quantities, monitoring and collecting the data, assessing and evaluating the information, formulating meaningful user displays, and performing decision-making and alarm functions are enormous. The information needed by smart environments is provided by Distributed Wireless Sensor Networks, which are responsible for sensing as well as for the first stages of the processing hierarchy. The importance of sensor networks is highlighted by the number of recent funding initiatives, including the DARPA SENSIT program, military programs, and NSF Program Announcements. The figure shows the complexity of wireless sensor networks, which generally consist of a data acquisition network and a data distribution network, monitored and controlled by a management center. The plethora of available technologies makes even the selection of

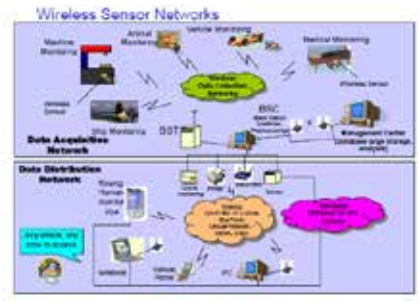


Fig1 .wireless sensor network

components difficult, let alone the design of a consistent, reliable, robust overall system.

II. POWER-AWARE DESIGN

Sensor network technology has faced several challenges in hardware, communication protocol and application design in order to be a reality [3]. Advances in MEMS (Micro Electro Mechanical Systems) technology, radio circuitry and DSPs, have help to overdraw these challenges in a more or less successful way. Some of those challenges are [1,4]:

- Low cost (hundreds to thousands nodes per network).
- Low power consumption (battery supplied lifetime of 3–5 years).
- Network intelligence for data gathering (autonomous networks without human management).
- Resource limited nodes (energy power supply, Computational capacity and memory).
- Dynamical reaction to changing network conditions and topology modifications.
- Minimum impact (nodes have to be small and go unnoticed).
- Reliability (Fault tolerance thanks to high level redundancy).
- Measurement accuracy improvement (processed information from many distributed sensors).

Furthermore, a sensor node has a high consumption element: the radio module. This is an essential module in a wireless sensor network node, but reducing the dissipated energy in communication is the hardest task in developing a highly dense wireless sensor network of scattered micro nodes .Unlike in other wireless networks, such as MANET,Bluetooth or HomeRF, sensor networks can have around hundreds or even thousands of nodes, generally stationary, where QoS (Quality of Service) is not the first objective, but making sensors' life as longer as possible. In fact, in these kind of networks, network connectivity degradation is not dependent on the mobility of the nodes but on their battery lives. That's why node's and network's global performance highly depends on the energy efficiency of the implemented

algorithms [5].

III. NODE POWER CONSUMPTION

The first step in wireless sensor network power aware design is identifying which parts of a sensor node need more power supply than the others:

- Control unit gives intelligence to a sensor node. Its main purpose is controlling the sensing parts and executing the communication protocols and the data processing algorithms [5,6].

Volume : 1 | Issue : 3 | Aug 2012 • ISSN No 2277 - 8179

• The radio module of a sensor offers wireless communications with its neighbourhood and external world. Several factors have influence in radio module power consumption, such as, modulation scheme, data rate,transmission power and duty cycle. In general, radio modules work in four different stages: Transmission,Reception, Idle (module is on but not transmitting or

receiving) and Sleep (switched off). In most radio modules,it is important to take into account that Idle state wastes as much energy as reception state. Therefore, a very important point is switching off completely the radio module whenever there is no transmission or reception

scheduled, instead of leaving it in Idle state. Furthermore, a working state change generates a transitory activity in the radio module's circuitry that leads to a important energy

dissipation [7]. There are several researches about how radio module transmitted energy control affects in packet

broadcasting in the network and how that would modify its behaviour. As a result, there are some mechanisms that offer power control adjustment, such as COMPOW (COMmon POWer), CLUSTERPOW (CLUSTER POWer),

MINPOW (MINimum POWer) and Flexible Power Scheduling (FPS) [8].

- Transducers translate physical magnitudes to electric signals and can be classified in active ones and passive ones. Passive sensors do not need power supply for measuring while active ones require a external energy. In general, passive sensors' energy consumption is not significant in comparison with the rest of the components of the node.

- Every node component is battery-powered, so these parts play a very important role in node lifetime. Batteries are not simple devices, and their operation depends on many factors, such as battery dimensions, type of electrode material and some nonidealities that can appear during

Normal operation and decrease system lifetime. Moreover, for the nodes to be useful and easily deployable, they have to be small, which limits seriously the possibility of including a battery large enough to supply energy for all its

lifetime (3–5 years).

V WIRELESS SENSOR NETWORKS

Sensor networks are the key to gathering the information needed by smart environments, whether in buildings, utilities, industrial, home, shipboard, transportation systems automation, or elsewhere. Recent terrorist and guerilla warfare countermeasures require distributed networks of sensors that can be deployed using, e.g. aircraft, and have self-organizing capabilities. In such applications, running wires or cabling is usually impractical. A sensor network is required that is fast and easy to install and maintain.

The WSN'S are composed of a large no. of sensor nodes. Therefore, an algorithm for a WSN is implicitly a distributed algorithm. In WSN'S the scarcest resource is energy & one of the most energy expensive operations is data transmission. Hence, for this reason ,algorithmic research in WSN mostly focuses on the study & design of energy aware.

In this paper, we use the sensors which are hardware devices that produce measurable response to a change in a physical conditions like temperature & pressure. Sensor sense or measure physical data of the area to be monitored. The continual analog signal sensed by sensors is digitized by an ADC & sent to the controller for further processing.

System Diagram:

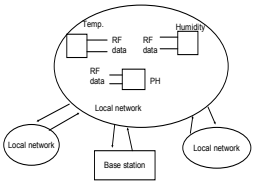


Fig2: system diagram

Local Network :

It consist of three sensor nodes which are : Temperature ,Humidity, & PH level which equipped with a limited power source of less than 0.5 Ah & 1.2v.

Characteristics of sensor node:

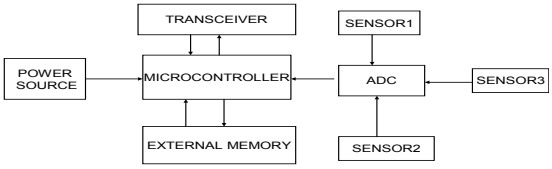
1. Small size
2. consume extremely low energy
3. Operate in high volumetric density
4. Adaptive to the environment.

Base station:

WSN network consist of data receiving hub that transmit & receive the data. The base station act as a gateway between sensor nodes & user.

BLOCK DIAGRAM FOR SENSOR NODE:

Fig 3.Block diagrams



Components of a sensor node:

1.Microcontroller
2. Transceiver
3. External memory
4. Power source
5. ADC
6. One or more sensors

1. Microcotroller:It perform the tasks ,processes data & controls the functionality of other components.
2. Transceiver :It uses radio frequency as wireless transmission media.
3. External memory:It can be on-chip memory or flash memory.
4. Power source :Battery or capacitor. More energy is required for data communication.
5. Sensor:Sensor is a device that converts physical parameters into a electrical signal .For the sensor networking we use three different types of sensors like,

· Temperature sensor
· Humidity sensor

PH level sensor

Temperature sensor LM35:

The LM35 series are precision integrated-circuit temperature sensors,

whose output voltage is linearly proportional to the Celsius (Centigrade) temperature.

The LM35 thus has an advantage over linear temperature sensors calibrated in §

Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling.

The LM35 does not require any external calibration or trimming to provide typical accuracies of g(/4§C at room temperature and g*/4§C over a full b55 to a150§C

temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make

interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 mA from its supply, it has very low self-heating, less than 0.1§C in still air.

HUMIDITY SENSOR SY-HS-220 LDT:

This sensor converts relative humidity to the output voltage.

Relative humidity(RH):

RH is a the ratio of (stated as a percent) of the moisture content of air compared to the saturated moisture level at the same temperature and pressure.

VI CONCLUSION

Wireless sensor networks (WSNs) are application specific networks and depending upon application requirement may need

an operational lifetime of months to years. Therefore, it is mandatory to give the utmost priority to WSNs' design. This paper surveys the main approaches to energy conservation in WSNs. The sensor's wireless communication ability facilitates distributed sensing and thus, makes WSNs distributed in nature Power-aware routing protocols and topology management ensure that the burden of forwarding traffic is distributed between nodes in an energy-efficient way. Data gathering techniques illustrate the effectiveness of exploiting network-wide computation-communication trade-offs. Further energy optimization is possible by reducing packet size. To increase sensor node's lifetime, integration of harvesting technologies, low power sensor network design, and energy-aware protocols is mandatory.

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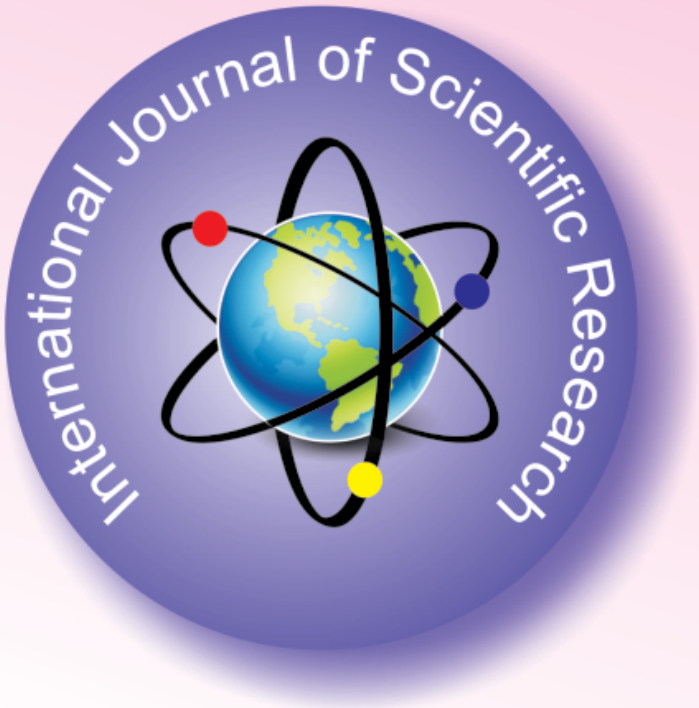

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