EMBEDDED WIRELESS SENSOR NETWORKS FOR ENERGY SAVING SYSTEM BASED ON SENSORS

B. SARIKA [1], J.V. PRABHAKAR RAO [2]

[1] PG Scholar, Dept Of ECE, Adams Engineering College, Paloncha Mandal, Khammam Dist, T.G, India

[2] Assistant Professor, Dept Of ECE, Adams Engineering College, Paloncha Mandal, Khammam Dist, T.G, India

Abstract: The development of wireless sensor networks has reached a point where each individual node of a network may store and deliver a massive amount of (sensor-based) information at once or over time. In the future, massively connected, highly dynamic wireless sensor networks such as vehicle-2-vehicle communication scenarios may hold an even greater information potential. This is mostly due to the increase in node complexity. Consequently, data volumes will become a problem for traditional data aggregation strategies traffic-wise as well as with regard to energy efficiency. Therefore, in this paper we suggest to call such scenarios big data scenarios as they pose similar questions and problems as traditional big data scenarios. Although the latter focus mostly on business intelligence problems. We then propose an aggregation strategy tied to technological prerequisites which enables the efficient use of energy and the handling of large data volumes. Furthermore, we demonstrate the energy conservation potential based on experiments with actual sensor platforms.

Key words: Zigbee Gprs,wireless technology, Sensors, Control devices.

I. Introduction

The total amount of user data (data payload) to be stored or processed doubles every two years. This fact raises several problems regarding data management and time-critical data processing tasks. In order to handle these issues, researchers all over the world are concentrating their work under the topic ”big data”. If we talk about big data research, we consider novel approaches for the processing of huge amounts of data from different, heterogeneous sources. Key problems include search strategies, data dissemination, automated analysis as well as the visualization and post processing.Big data environments in a traditional manner deal with massive, centralized computing resources, e.g. high performance computing centers and high-speed storage systems.Typical scenarios focus on data mining scenarios, financial computing (fraud detection) and scientific data evaluation as well as pattern recognition. The majority of research and development activities in this field focus on existing information in larger volumes than the amount of data usually handled with relational database systems. Today, the actual research focus changes rapidly. Several big data projects deal with huge amounts of multi-dimensional data in embedded, distributed systems. Accordingly, a different application context requires different strategies. For example, if we consider next generation driver assistance systems,Vehicle-2-Vehicle (V2V) or Vehicle-2-Roadside concepts, a large amount of sensor data is generated and needs to be fused and evaluated. Additionally, such tasks require local preprocessing techniques for distributed scenarios, for instance the evaluation and classification of data received by imaging systems. Besides automotive applications, further scenarios address advanced sensor and monitoring systems as well as smart metering approaches, which are operating in a highly integrated and connected environment.

II. The Hardware System

Micro controller: This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

ARM7TDMI: ARM is the abbreviation of Advanced RISC Machines, it is the name of a class of processors, and is the name of a kind technology too. The RISC instruction set, and related decode mechanism are much simpler than those of Complex Instruction Set Computer (CISC) designs.

ZIGBEE: ZIGBEE is a new wireless technology guided by the IEEE 802.15.4 Personal Area Networks standard. It is primarily designed for the wide ranging automation applications and to replace the existing non-standard technologies. It currently operates in the 868MHz band at a data rate of 20Kbps in Europe, 914MHz band at 40Kbps in the USA, and the 2.4GHz ISM bands Worldwide at a maximum data-rate of 250Kbps.

Temperature sensor: Temperature sensors are devices used to measure the temperature of a medium. Examples of this include maintaining the temperature of a chemical reactor at the ideal set-point, monitoring the temperature of a possible runaway reaction to ensure the safety of employees, and maintaining the temperature of streams released to the environment to minimize harmful environmental impact.

Light sensor: we use the light sensor to measure the light intensity in the environment.

III. Design of Proposed Hardware System

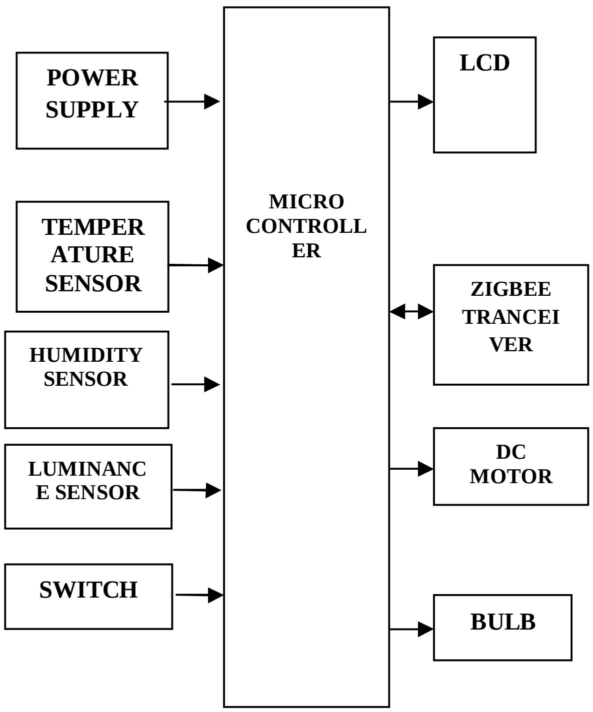

Fig.1. Node Section1 section

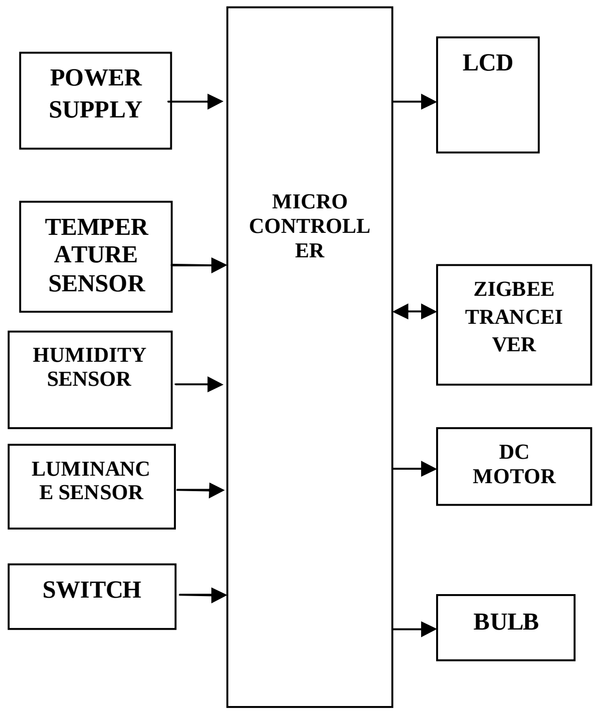

Fig.2. Node Section2 section

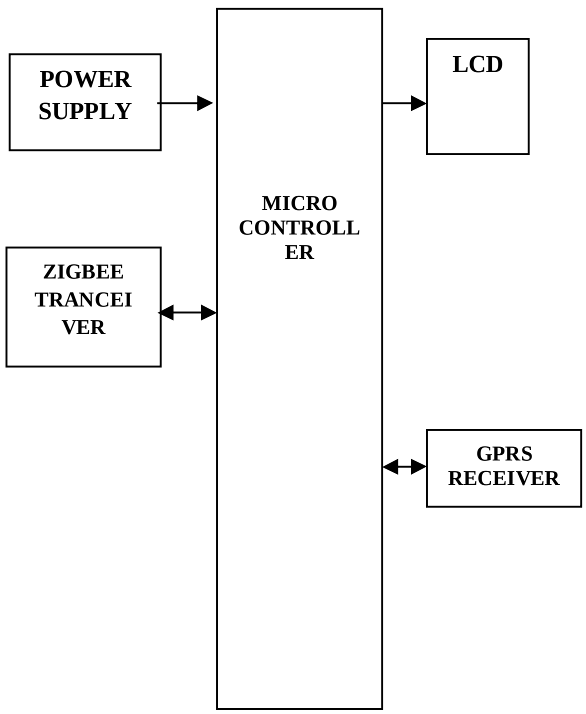

Fig.3.Control section

A building automation system deals with monitoring and control of building services, such as light, Fan, LED, alarms, etc. Wireless communication is the transfer of information over a distance without the use of electrical conductors or wires. The distances involved may be short (a few meters as in television remote control) or long (thousands or millions of kilometers for radio communications).It encompasses various types of fixed, mobile, and portable two-way radios, cellular telephones, personal digital assistants (PDAs), and wireless networking. We tested ZIGBEE networks in various environmental conditions by using four node star networks for industrial applications like speed and direction control of D.C motor, Illumination control of incandescent lamp and closed loop water path temperature control. It was seen that error free proper communication was established between the processing unit and monitoring unit. In future we can also test other ZIGBEE Networks for proper wireless data communication.

Here we are going to develop a wireless technology for data acquisition of parameters like lighting control, temperature control etc in a building. In this system we are monitoring the data for temperature and light present in a Building,the data regarding temperature, light is displayed in a LCD. The transmit ion of data is done using a ZIGBEE transceiver through micro controller. This data is received by ZIGBEE receiver and displays it in LCD in the monitoring section which will be with a person in that building. Using this data the operator can control the devices by giving the necessary commands, this commands are received by control devices in the processing unit and performs the operations. If any fault occurs the sensors detects the error and makes the buzzer to buzz. Simultaneously it also sends a message to mobile and we can also control with our mobile by sending a message.

IV. Board Hardware Resources Features

ZIGBEE Technology:

The ZIGBEE specification is a combination of Home RF Late and the 802.15.4 specification. The specification operates in the 2.4GHz (ISM) radio band - the same band as 802.11b standard, Bluetooth, microwaves and some other devices. It is capable of connecting 255 devices per network. The specification supports data transmission rates of up to 250 Kbps at a range of up to 30 meters. ZIGBEE's technology is slower than 802.11b (11 Mbps) and Bluetooth (1 Mbps) but it consumes significantly less power.

802.15.4 (ZIGBEE) is a new standard uniquely designed for low rate wireless personal area networks. It targets low data rate, low power consumption and low cost wireless networking, and its goal is to provide a physical-layer and MAC-layer standard for such networks.

Wireless networks provide advantages in deployment, cost, size and distributed intelligence when compared with wired networks. This technology allows users to set up a network quickly, and allows them to set up networks where it is impossible or inconvenient to wire cables. Wireless networks are more cost-efficient than wired networks in general.

Bluetooth (802.15.1) was the first well-known wireless standard facing low data rate applications. The effort of Bluetooth to cover more applications and provide quality of service has led to its deviation from the design goal of simplicity, which makes it expensive and inappropriate for some simple applications requiring low cost and low power consumption. These are the kind of applications this new standard is focused on. It's relevant to compare here Bluetooth and ZIGBEE, as they are sometimes seen as competitors, to show their differences and to clarify for which applications suits each of them.

The data transfer capabilities are much higher in Bluetooth, which is capable of transmitting audio, graphics and pictures over small networks, and also appropriate for file transfers. ZIGBEE, on the other hand, is better suited for transmitting smaller packets over large networks; mostly static networks with many, infrequently used devices, like home automation, toys, remote controls, etc. While the performance of a Bluetooth network drops when more than 8 devices are present, ZIGBEE networks can handle 65000+ devices.

GPRS:

GPRS technology enabled much higher data rates to be conveyed over a cellular network when compared to GSM.GPRS technology offering data services with data rates up to a maximum of 172 kbps, facilities such as web browsing and other services requiring data transfer became possible. GPRS and GSM are able to operate alongside one another on the same network, and using the same base stations. However upgrades are needed. The network upgrades reflect many of those needed for 3G, and in this way the investment in converting a network for GPRS prepares the core infrastructure for later evolution to a 3G W-CDMA / UMTS.

Temperature Sensor - The LM35

The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature (in ^{o}C)

The LM35 - An Integrated Circuit Temperature Sensor

- You can measure temperature more accurately than a using a thermistor.
- The sensor circuitry is sealed and not subject to oxidation, etc.
- The LM35 generates a higher output voltage than thermocouples and may not require that the output voltage be amplified.

Fig.4. Temperature sensor

Working of LM35:

1. It has an output voltage that is proportional to the Celsius temperature.
2. The scale factor is .01V/^{o}C
3. The LM35 does not require any external calibration or trimming and maintains an accuracy of +/-0.4 ^{o}C at room temperature and +/- 0.8 ^{o}C over a range of 0 ^{o}C to +100 ^{o}C.
4. Another important characteristic of the LM35DZ is that it draws only 60 micro amps from its supply and possesses a low self-heating capability. The sensor self-heating causes less than 0.1 ^{o}C temperature rise in still air.

The LM35 comes in many different packages, including the following.

- TO-92 plastic transistor-like package,
- T0-46 metal can transistor-like package
- 8-lead surface mount SO-8 small outline package
- TO-202 package. (Shown in the picture above)

LDR: LDRs or Light Dependent Resistors are very useful especially in light/dark sensor circuits. Normally the resistance of an LDR is very high, sometimes as high as 1000 000 ohms, but when they are illuminated with light resistance drops dramatically.

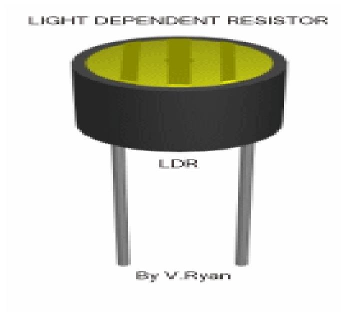

Fig.5. LDR sensor

The animation opposite shows that when the torch is turned on, the resistance of the LDR falls, allowing current to pass through.

V. Conclusion

In this paper, we introduced two cases where we see data aggregation in embedded, wireless networks as big data applications. The first case represents sensor networks with a high node density so that the combination of the sensor data collected by each node is enormous. The second case deals with networks with high node complexity (such as vehicles) where each individual node holds a multitude of sensor data and deductions. Within such networks, traditional aggregation approaches reach their limits with respect to energy-efficiency.With further developments, such as vehicle-to-vehicle communication networks and the smartdust vision, the efficient handling of big data volumes in embedded, wireless sensor networks is growing more and more important. Therefore,if we speak about more than thousand (probably energy self-sufficient) network nodes, self organization and energy efficiency are the main points to consider and optimize. There have to be flexible and robust ways of self-organization for such networks as well as a dynamic way to extract data from them.

VI. REFERENCES

[1] X. Wu, X. Zhu, G. Wu, and W. Ding, "Data mining with big data," *Transactions on Knowledge and Data Engineering*, vol. 99, June 2013.

[2] G. Jung, N. Gnanasambandam, and T. Mukherjee, "Synchronous parallel processing of big-data analytics services to optimize performance in federated clouds," in *Proceedings of the IEEE 5th International Conference on Cloud Computing*. IEEE Computer Society, 2012, pp.811–818.

[3] Y. Demchenko, Z. Zhiming, P. Grosso, A. Wibisono, and C. de Laat,"Addressing big data challenges for scientific data infrastructure," in *Proceedings of the IEEE 4th International Conference on Cloud Computing Technology and Science*. IEEE Computer Society, 2012,pp. 614–617.

[4] M. Rezaei, M. Sarshar, and M. M. Sanaatiyan, "Toward next generation of driver assistance systems: A multimodal sensor-based platform," in *The 2nd International Conference on Computer and Automation Engineering (ICCAE)*, vol. 4, February 2010, pp. 62 – 67.

[5] S. Blokzyl, M. Vodel, and W. Hardt, "A hardware accelerated real-time image processing concept for

high-resolution eo sensors,"in *Proceedings of the 61. Deutscher Luft- und Raumfahrtkongress*.Berlin, Germany: Deutsche Gesellschaft fr Luft- und Raumfahrt,September 2012. [Online]. Available: http://d-nb.info/1028174624

[6] K. Fall, "A delay-tolerant network architecture for challenged internets,"in *Proceedings of the International Conference on Applications, Technologies, Architectures, and Protocols for Computer Communications (SIGCOMM)*. ACM, 2003, pp. 27–34.

[7] M. Vodel and W. Hardt, "Data aggregation in resource-limited wireless communication environments - differences between theory and praxis,"in *Proceedings of the International Conference on Control, Automation and Information Sciences (ICCAIS2012)*. Ho Chi Minh City, Vietnam: IEEE Computer Society, November 2012, pp. 282–287.

[8] M. Vodel and W. Hardt, "Data aggregation and data fusion techniques in wsn/sanet topologies - a critical discussion," in *Proceedings of the TENCON 2012*. IEEE Computer Society, November 2012, pp. 1–6.

[9] D. Laney, *The Importance of 'Big Data': A Definition*. Gartner, 2012.

[10] S. Madden, R. Szewczyk, M. J. Franklin, and D. Culler, "Supporting Aggregate Queries Over Ad-Hoc Wireless Sensor Networks," in *Proceedings Fourth IEEE Workshop on Mobile Computing Systems and Applications*, 2002, pp. 49–58.

[11] *TinyDB - A declarative database for sensor networks*, Berkeley University of California Std. [Online]. Available: telegraph.cs.berkeley. edu/tinydb/doc/tinydb.html

[12] *COUGAR*, Cornell University Std. [Online]. Available:www.cs.cornell.edu/bigreddata/cougar/index.php

[13] M. Vodel, Topologieoptimierung in Mobilen Ad Hoc und Sensornetzwerken: Systematische Evaluierung und Vergleich dezentraler Algorithmen zur optimierten Vernetzung selbstorganisierender Systeme (Topology optimization in mobile ad-hoc and sensor networks: systematic evaluation and comparison of decentralized algorithms for optimal routing in self-organized systems). Vdm Verlag, 2008.

[14] V. Markl, *Encyclopedia of Database Systems*. Springer-Verlag Berlin Heidelberg, 2009, ch. Query Processing (in Relational Databases).

[15] M. Vodel, M. Caspar, and W. Hardt, "Critical parameters for the efficient usage of wake-up-receiver technologies," in *Proceedings of the International Conference on Computer Applications and Network Security (ICCANS2011)*, 2011, pp. 100–105.

[16] M. J. Miller and N. H. Vaidya, “Minimizing energy consumption in sensor networks using a wakeup radio,” in *Proceedings of the Wireless Communications and Networking Conference. WCNC. 2004 IEEE*, vol. a, March 2004, pp. 2335–2340.

[17] Chair of Computer Engineering, Technische Universitat Chemnitz,¨“Planet - platform for ambient networking,”ww.ce.informatik.tuchemnitz.de/forschung/demonstratoren/planet/, September 2013.

[18] M. Vodel, R. Bergelt, and W. Hardt, “A generic data processing framework for heterogeneous sensor-actor-networks,” International Journal On Advances in Intelligent Systems, vol. Vol. 4, December 2012.

[19] M. Vodel, R. Bergelt, and W. Hardt, “Grease framework – generic reconfigurable evaluation and aggregation of sensor data,” in Proceedings of the 2nd International Conference on Smart Grids, Green Communications and IT Energy-aware Technologies (ENERGY2012 /InfoSys2012), March 2012.