Minimizing Consumption of Energy in Wireless Sensor Networks by Using MSP430F149

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Abstract-The sensor nodes in wireless sensor networks are used for various applications like gas and temperature monitoring [1]. Every sensor node in wireless sensor networks is some energy constrained. So minimization of power consumed by each sensor node in WSN network is need of hour, so that deployed of sensor node in WSN network will live for long period of time. In this paper ,we presents the components which are used in sensor node is less energy constrained and energy aware sensor node, which minimize the power consumed in node level and network level respectively. By comparing two sensor nodes having different microcontroller ATMEL and MSP430.The results shows, power consumed by nodes 5.2mW and 1.46mW respectively, Further more energy aware sensor node select the path with MSP430 as intermediate and reduce the power consumed at network level.

Indexterm: Wireless sensor network, MSP430F149, Energy consumption

I. Introduction

Wireless sensor network (WSN) technology is used in military and civil area so that it gaining popularity day by day in a wide area of different applications. But energy consumption is key factor for deployment of sensor node in wireless sensor networks. Sensor nodes are driven by batteries, but diminutive amount of energy provided by theses battery to sensor node for a month. So battery substitute is not a option for large network where thousands of sensor node are deployed in a rough physical environment, changing battery and recharging is not possible during operation. One of the basic solutions is that to minimize the energy consumption in both network level and node level in wireless sensor network. In this paper, presents the energy consumption in node level by using ultralow power microcontroller MSP430F149 as core for sensor node and in network level a sensor node automatic choose a path which consumes less energy for disseminating the data to cluster head node, and cluster head to destination. We use a module in which two sensor node having two different microcontroller, gas sensor, temperature sensor and Zigbee. The reminder of this paper is organized as follow. Section II Energy saves at node level, section III Energy saving at network level. The conclusion will be finally drawn in section IV

II. ENERGY SAVING AT NODE LEVEL

In sensor node there are four basic components: controller, sensor, and communication device and power unit.

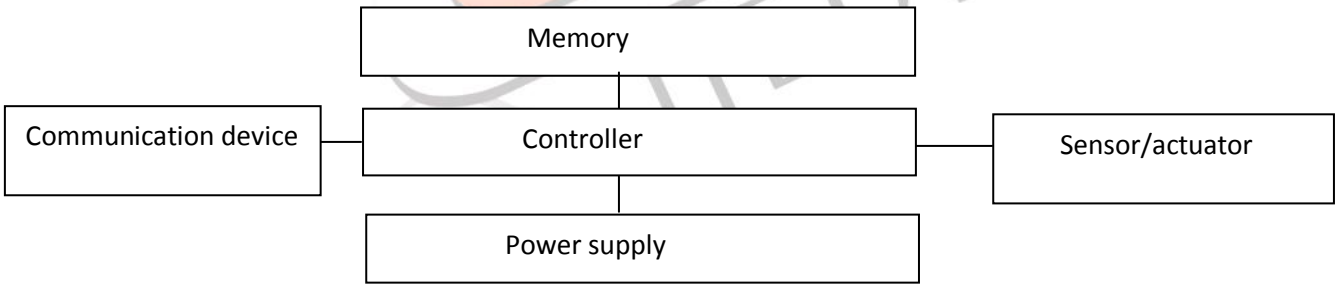

Fig. 1 Main sensor node hardware component

A controller is core of wireless sensor node. It collect to process all the relevant data, capable of executing arbitrary code, and collect data from sensors, process this data, decide when and where to send it, receive data from other senor node, and decides on the actuator's behavior, many microcontroller are available for industry purpose. In this paper, we use comparing to ATMega 103L and ultralow power microcontroller MSP430F149. Table .1 shows various characteristics of microcontroller.

TABLE.1 COMPARISON OF MICROCONTROLLERS

Characteristatic	**ATMega 103L**	**MSP430F149**
Operating voltage	2,7- 3,6 v	1.8,-3.6v
Active current	5.5mA	0.4mA
Current in power ideal mode	1.6mA	.0013mA
Current in power down mode	<1µA	<0.1 µA
FLASH	0.125Kbyte	60Kbyte

On comparing thecharacteristic of microcontroller MSP430F149comes out to be the most prominent choice and consider as a core component in sensor node. By using MSP430F149 microcontroller design a sensor node module, this microcontroller has five low power modes (LMP0 – LMP4). LMP4 is the deepest sleep mode in that it consume very less power i.e 0.3 µW while in LMP3 it consume 6 µW. Table .2 shows current consumption my MSP430F149 microcontroller. In LPM4 mode CPU, ACLK, MCLK and SMCLK is disabled. That's way mode LPM4 will consume very less energy.

TABLE. 2 CURRENT CONSUMPATON OF EACH MODE FOR MSP430F149

Mode	**Current consumption (µA)**
Active	160
LPM0	55
LPM1	40
LPM2	17
LPM3	1.6
LMP4	0.1

Power consumption in node level can measure by using module, the fig 2 shows in the form of GUI with help of visual basic 6.0. The power consumed after five minute in both sensor nodes is comes out to be in GUI. The power consumed in MSP430F149 and ATMega103L are 1.466mW, 5.2mW respectively. We take three more readings by varying temperature and gas values, showing the results by table 3.

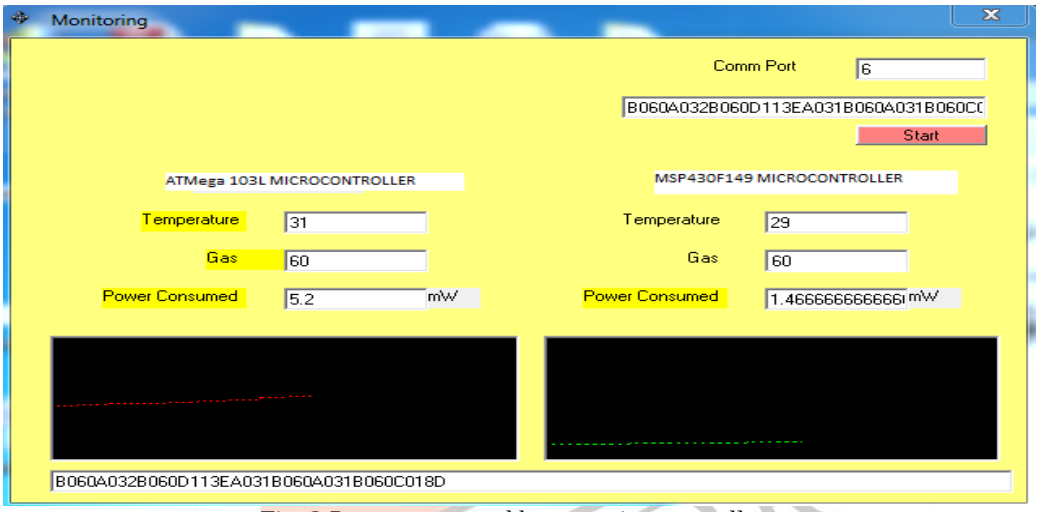

Fig .2 Power consumed by two microcontrollers

Three reading taken after varying temperature an gas values and respective power consumed will obtain by module which shown in table 3.

Temperature	**Gas**	**Power consumed (mW)**	**Power consumed (mW)**
		MSP430F149	ATMega 103L
28	60	5.2	1.46
33	66	7.4	3.26
37	70	8.8	3.4

TABLE .3 POWER CONSUMED BY TWO CONTROLLER

III Energy consumption in network level

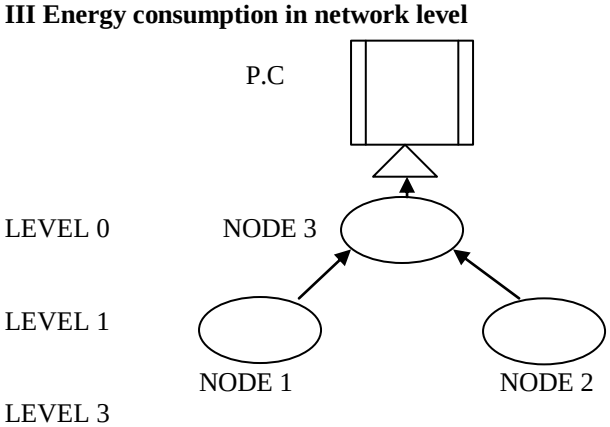

Fig .3(a)

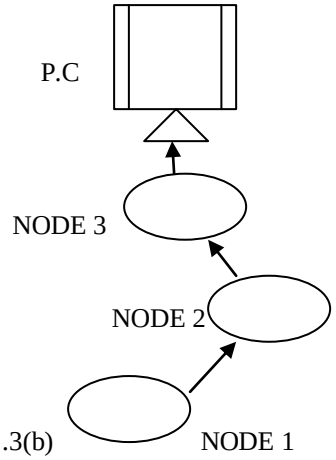

Fig .3(b)

Fig .3 Node Placements

NODE 1 – ATMega 103L, NODE 2- MSP430F149, NODE 3 –ZIGBEE (Receiving the data and show in P.C)In Fig 3(a) shows that NODE1 and NODE 2 are placed in same level i.e level 2, getting the data and sends the information to NODE 3.Results shown in P.C in the form of GUI by using visual basic 6.0.

In Fig 3(b) when NODE 1 move some distance back than it will adaptively choose a path which consume less energy. Fig .4 shows flow chart of algorithm which is programmed in ATMega 103L. NODE 1 sends the data to NODE 2 (MSP430F149)and NODE 2 receive the data and send to NODE 3,in this way select the path which consumed less energy and finally NODE 3 sends the data to P.C, which shows minimum energy consumed as compared network in Fig .3(a).

With the help of flow chart shown in Fig .4, if threshold value is greater than value read than node choose neighbor node and route the data which consume less energy as compared to network arrangement shown in Fig .3(a).

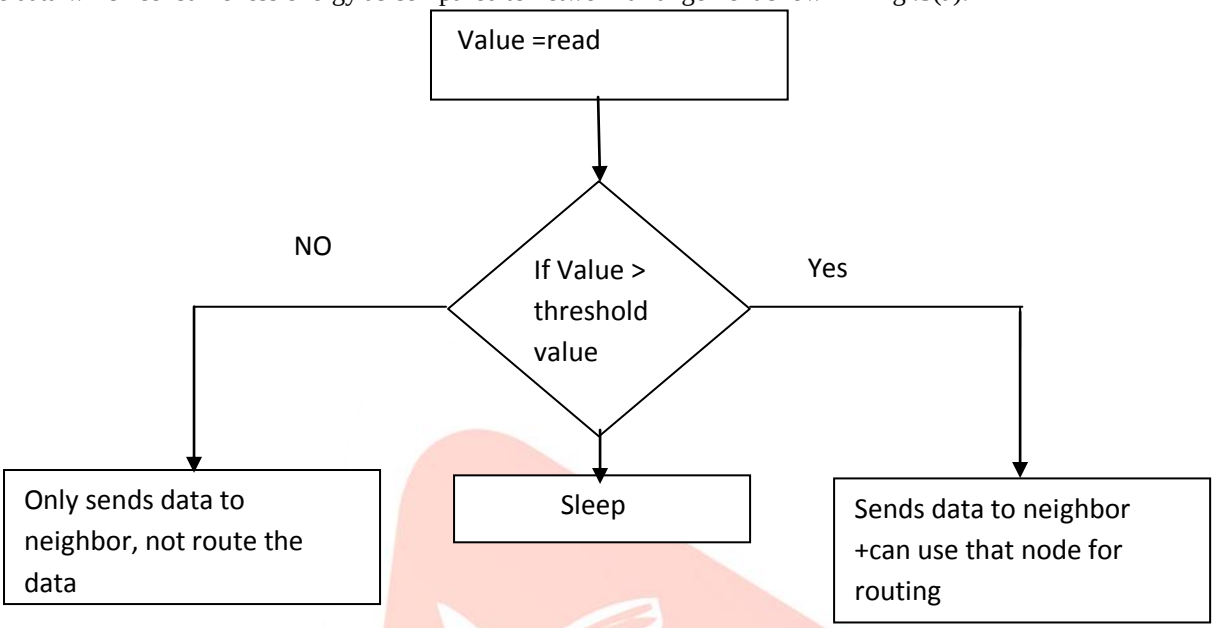

Fig. 4 Adaptive selecting path

IV CONCLUSION

In this paper, the energy efficient strategy is used in node level and network level. The node level energy saving is achieved by using ultralow power MSP430F149 microcontroller as core component in sensor node. Which reduces the power consumed great extant at node level which is shown in result. In network level, sensor node choose adaptive path which consumed less power by setting threshold value

For further study, more functionality such as data fusion algorithm and data processing will added to sensor node. Which improves the results?

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