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Hardaware Realization of Parameter Sensing Unit with Data Aggregation

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ABSTRACT: Wireless sensor nodes are rapidly used in many application, such as fire monitoring, forest monitoring and military surveillance. Sensor node which send sensed data. As sensor nodes are battery driven, an efficient use of power is essential in node for long time hence it is needed to reduce data traffic inside sensor node. For WSN, a data aggregation function reduces communication and power consumption required for the transmission. Sensor node is resource constrained, so it is very important to collect data precisely. Sensor node requires less power for processing as compared to transmission of data. It is preferable process inside node and reduce packet transmission. One such approach is data aggregation. Data aggregation is used to reduce the number of transmissions and save energy by aggregation of multiple data packets into an aggregated data packet in wireless sensor node. Data Aggregation algorithm is based on event or time.

KEYWORDS:Wireless sensor node, data aggregation, in-node aggregation, count aggregation, aggregation protocol.

I. INTRODUCTION

Sensor node is composed of small and cost effective sensing device with wireless radio transmitter for environment monitoring have more feasible. **W**ireless sensor node is widely used in many applications like forest fire monitoring, temperature monitoring and military surveillance [1]. The sensor node can monitor the environment parameter by collecting information from near area and send data to destination. Data aggregation protocol aims for eliminating redundant data transmission and thus improves the lifetime of energy constrained sensor node. Sensor node deployed on the field, a sensor node is limited source constrained in storage, computation power. The information collected from the node is sent through wireless media required power. A function used for data acquisition systems for sensor node performs in-node aggregation protocol. Mostly data aggregation functions are the time based. Data aggregation is function of process of aggregating the sensor information by aggregation approaches. The function uses sensor data and then aggregates the data by using aggregation function such as average, RMS, Min, Max. In this paper, we designed the system hardware implementation parameter of sensing unit and an algorithm for aggregation. The algorithm used to aggregation is count.

II. RELATED WORK

The many of researchers have studied on the data aggregation in WSN. To computes aggregates, such as the sumand count proposed in [1]. The recent works has started to consider nearby sensor nodes for the use the function of data aggregation. Such provides event information readings, so only a minimum amount of power is needed to deliver the message to the user. Several of aggregation protocol has been designed for the aggregation node. It is not easy to works on the in-node aggregation process on data. A time-based function was designed for data aggregation algorithm. The function is used in probability counting algorithm for counting the number attempts and check for the event in each attempts. Count function can be explain as a coin-tossing experiment test with a hash function as random data gives output in the form of 1 or 0, which check for the event occurrences. In each attempts check for event occurrence and if event not occur for define attempts then return the attempt number [2}.

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The increased use of the energy resources and active distribution network require new model for operation of power system. Monitoring the power transfer network is mainly in power quality (PQ) framework. The RMS values are applied to values taken from the successive aggregation of data available for long term observation. The end-user needs for information and data resulting from averaging over one period of the observed quantities (i.e. rms value) has be done by data aggregation over the time axis. The aggregation process in time and space using data obtained from non-aggregated value. [3]

III. DESIGN METHODOLOGY

The system is divided into two parts. The first unit consists of sensing unit and in second part aggregation unit. Block diagram of the system as shown in the fig. 1

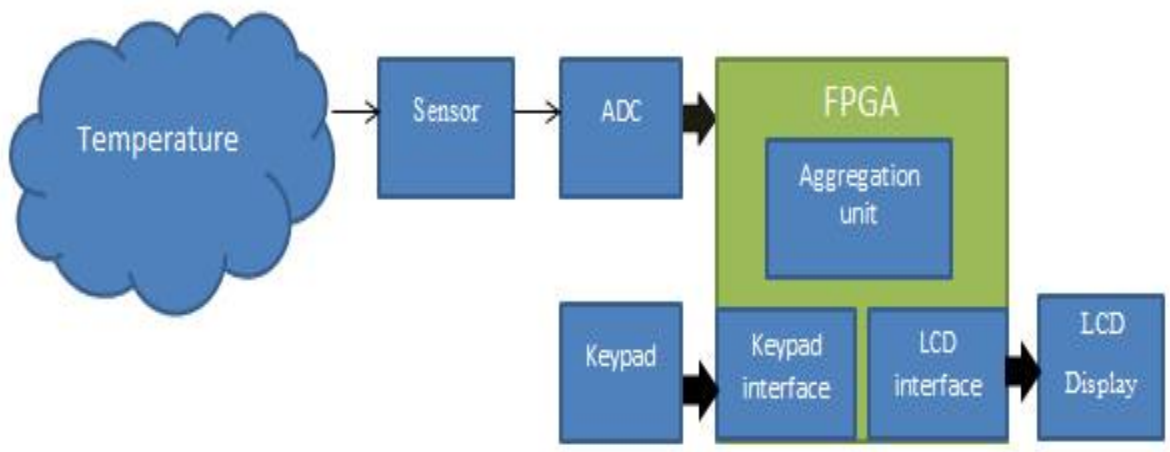

Fig 1.Block diagram of sensor node system

The system divided into two parts. In first unit consist of sensing unit second part of aggregation unit. The sensing unit senses the parameter such as temperature by sensor. The sensor signal amplify in the signal conditioning block and ADC convert signal analog to digital form. Sensor reading is the result of the ADC sampling process using 10 bits. The reference voltage is 3.3 volts. The internal voltage sensor uses the FPGA's 10-bit ADC. The input signal can be directed to internal ADC in sample modes. The aggregation unit aggregated the ADC sample. The aggregation is done on the FPGA. It is important to reduce to store the number of sample. Its efficiently reduce the requirement to store data. In the display shows the store data sample. The keypad is used to accept set point from the user. The LCD is used to display parameter of the system. The parameter display on the LCD is memory location used, stored data sample, monitoring temperature of environment and set point which is set by the user.

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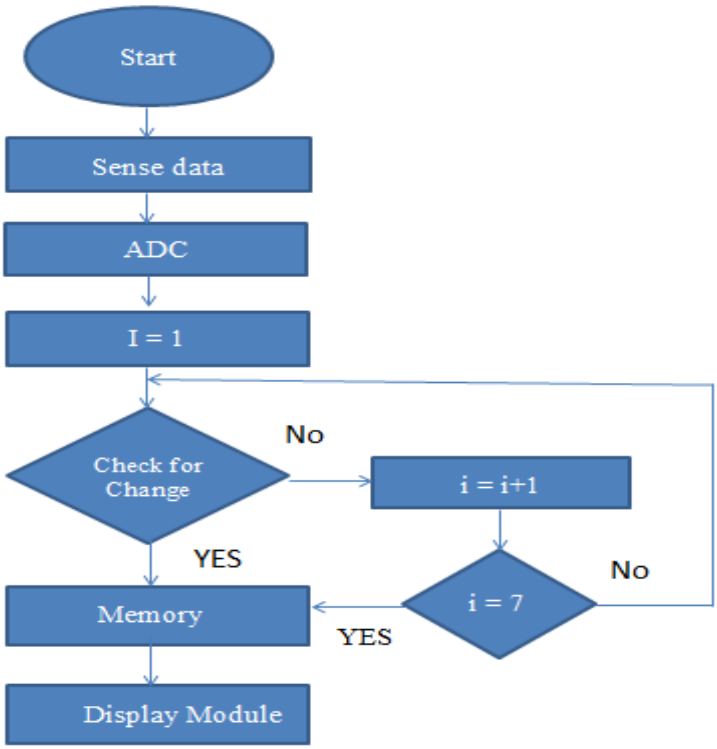

Fig 2: Flowchart for aggregation algorithm

The algorithm checks event in periodic manner. The user can set and offset is set to 2. The sample is between this ranges then it takes next attempts. IF sample it outside this range then change occurs. If change happen (sample outside the range) sample store in the memory and change not occurs (sample is in the range) then second attempts takes. Up to seven attempts sample fall in the range then sample store in the memory.

IV. RESULT AND DISCUSSION

The system output shown on the LDC display, the current temperature, set point, the number of memory location required to stored data sample. The interfacing of system shown in the fig 3.The system needs LCD to show the result of the system, ADC needs to convert analog senor data to digital to display the result of the sensing parameter. Here temperature sensor signals to ADC to monitor the temperature of surrounding. The LM 35 sensed the environment temperature and gives the data toanalog ADC which converts this sample into the digital data.

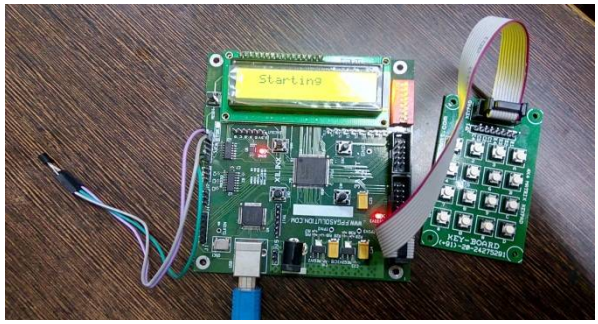

Fig 3: Interfacing of system

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The Fig.4 show the LCD display giving the temperature reading. The user set the set point of the temperature. The number of memory location shown on the LCD display required for stored data sample. The data shows the data sample stored on the memory.

Fig 4: LCD module shows parameter of the system

In without aggregation sample takes at 1s interval then data generate rate is very high it requires huge amount of memory to store this sample. In aggregation takes data into memory if event occurs and if event not generate it takes seven attempts to check event generate and upto7 attempts event not occurs then sample is save into the memory. The memory requirement in data aggregation is reduces. The data aggregation is based on both event and time.

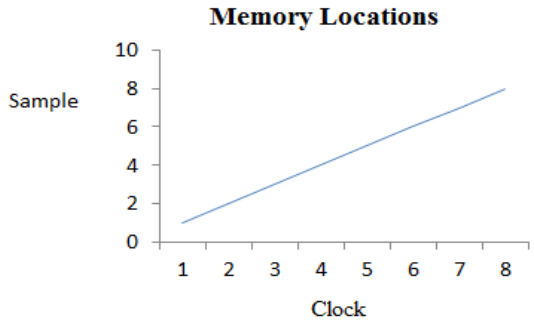

Fig 5: Memory requirement for without aggregation

The fig 5 shows the graph of memory requirement for without aggregation for without aggregation memory requirement increase linear with time. In with aggregation graph shown at fig 6 that in with aggregation memory increase if event occurs and up to 7 attempts event not occurs then sample store into the memory.

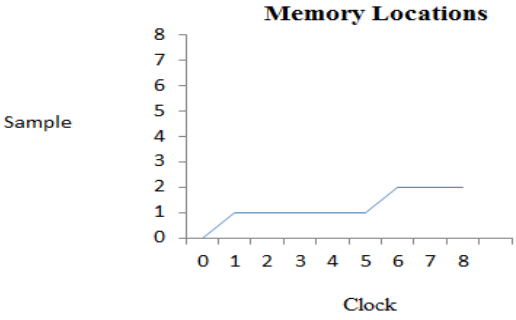

Fig 6: Memory requirement for with aggregation

The fig 6 graph shows difference between memory requirement in with and without aggregation. In with aggregation successful reduce in memory requirement.

The energy consumption sensor node is given by,

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$$E_x = Current * Voltage * Time$$

Where current is in Amperes, Voltage in Volts and Time is in seconds.

$$E_x = 20 * 10^{-3}A * 3Volts * 1S * \frac{1}{8\ bits} = \frac{7.5mJ}{bit}$$

Table 1: Number of packet store in memory

Method	Time	No. of Packet	No. of Bits
Without Aggregation	10s	10	80
With aggregation	10s	5	40

The fig 7 shows the comparison of energy consumption between without aggregation and with aggregation technique. The graph shows energy consumption between without aggregation and with aggregation technique.

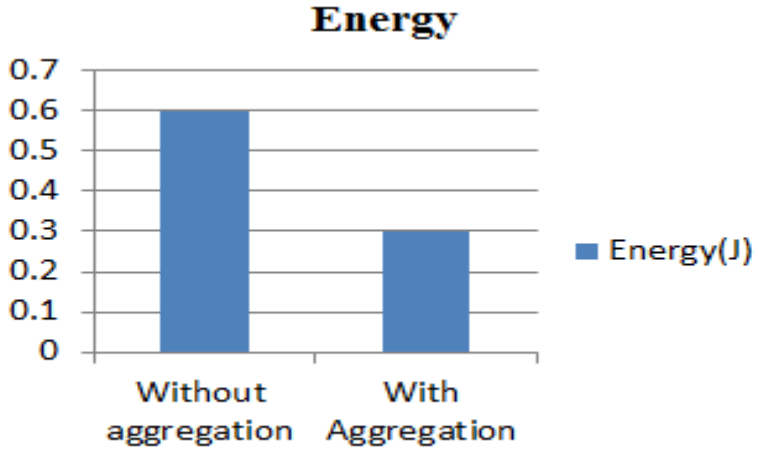

Fig 7: Energy consumption

V. Conclusion and Future Work

The sensor node generate huge amount of the sample. To store this sample needed huge amount of memory. Due to these memory wasted to store these samples. The aggregation leads to low data availability. The flexibly achieve in the algorithm for the balance between memory, timeliness and data availability. The data aggregation methodreduces storage requirement to store data sample. The algorithm is based on event driven and periodic driven. The future work is node security and accuracy.

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