International Journal of Innovative Research in Electronics and Communications (IJIREC)
Volume 1, Issue 4, July 2014, PP 7-11
ISSN 2349-4042 (Print) & ISSN 2349-4050 (Online)
www.arcjournals.org

An Real Time IWSN Based SCADA Network for Industrial Automation

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Abstract: *This paper is an RTOS based architecture designed for the purpose of data transmission between two controlling units through IWSN without data collision. RTOS is an OS which will create a platform between hardware and application. Here, stack is the one which is used to avoid the independency of the layers from one with another inside the protocol comes under the standard IEEE802.15.4. We are using the IEEE 802.15.4 to reduce the collision, timing integrity and extra traffic caused by the inter layer interaction in large industries with multi processor support.*

Keywords: *Real Time Operating System, Supervisory Control and Data Acquisition System, Industrial Wireless Sensor Network* **(***IWSN), PIC, LPC2148*.

1. INTRODUCTION

This paper deals with the data transmission between two units in the exact time without any collision. The data transmission time is increased with the protocol standard IEEE 802.15.4. One of the section runs with RTOS and LPC2148 as master node and another as normal data acquisition node to which sensors are connected. Data acquisition node uses the Peripheral Interface controller.

Communications between two nodes (hardware and application) are accomplished through IEEE 802.15.4. This wireless sensor node is composed of a micro-processors, transceivers, displays and analog to digital converters. Sensor nodes are deployed for industrial process monitoring and control. The sensing parameters can be displayed as graph in Master node.

The main aim of this paper is to monitor the industrial machine condition, intruder detection and to monitor these values at remote location through IWSN. To monitor the machine condition, we are using LM35 sensor which determines the heat generated by the machine and the pot which measures the voltage rating of the machine, when high power comes in to the industry this sensor gives analog voltage reading to monitoring section. By that we can know the condition of machine.

We have to convert these analog values into digital in order to monitor industrial parameters in GLCD, also we have to monitor the intruder, this set up is configured by IR sensor which is mounted near machine. So if any intruder breaks out this sensor detects and output is a buzzer sound as an alert.

In the existing system he bulks of messages are transmitted between nodes so there are chances of data collision in transmission.

In the proposed system we avoid this problem by optimizing the architecture and enhancing the system resources by implementing Real Time Operating System which manages these shared resources in real time environments; with this the RTOS provides power efficiency.

2. Blockdiagram

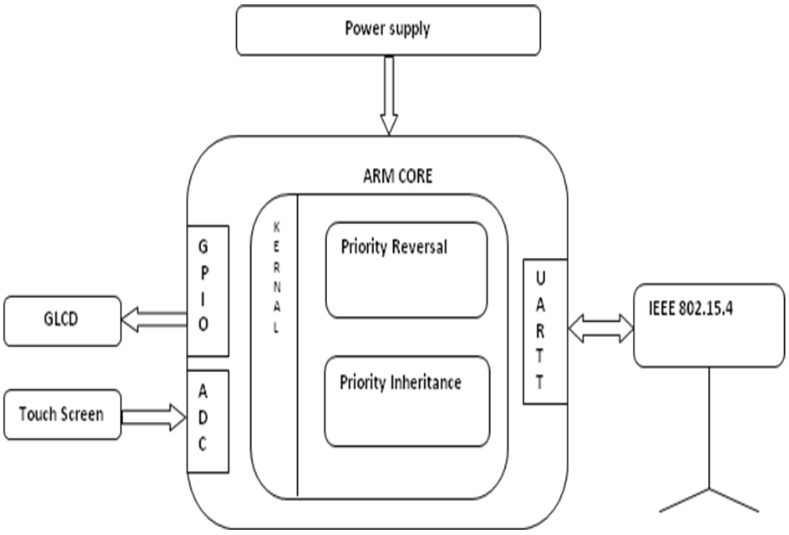

Fig1. *Master Node*

3. Data Acquisition Node

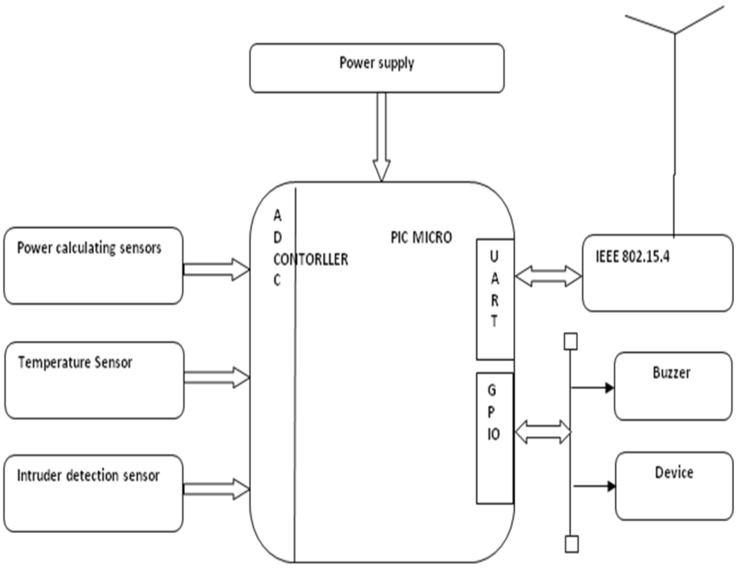

Fig2. *Data acquisition Node*

This system consist of two nodes one works with PIC and other with ARM7, to measure the sensor values of industrial machines all of these sensors are connected to PIC where all of the analog values are converted to digital i.e. the temperature, and pot values. This is done by ADCON0 and ADCON1, with 10 bit resolution in burst conversion, and keeps track of the analog sensor values continuously. These values represent the conditions of the machine, to monitor these values at the ARM node we have to transmit these values serially through UART with 9600 baud rate, 8 bit, 1 stop bit, and no parity. This is the functionality of the node one. Moreover this section also continually monitors the intruder, this is set up is configured by IR sensor which is mounted near machine. So if any intruder breaks out this sensor detects and Outputs a buzzer sound as an alert.

To monitor the machine parameters we have to receive the sensor values which are transmitted through PIC section, here in order to efficiently establish communication between two nodes ARM node is also configured with same UART configuration just as PIC, i.e. with 9600 baud rate, 8 bit, 1 stop bit, and no parity, this is done by configuring U0LCR register initially with DLAB=1, 8bit, 1stop bit, and no parity. After this configuration we have to load the latch register values as

U0DLL = [pclk/ (16*baud rate)] %256

And finally disable the DLAB bit.

The values which are received serially are stored in U0RBR register, now these have to display on GLCD as graph that too depending on user input selection which is done on Touch screen. This touch screen consists of four pins in them two pins are connected to ADC pins of ARM which calibrates the touch position with change of resistance.

So we would be fixing two values with calculated X & Y position of the screen. So depending on the value the respective sensor values can be displayed on the serene, this graph display is configured through page selection and data driven to GLCD. This is the complete system configuration.

Now ARM node which works with RTOS, It has the following resources:

- Touch resolution (ADC).
- Serial data reception (UART).
- Graph display (GPIO).

To get these resource functions we have to create a task in µ-COS2, this is done as follows:

```
INT8U OSTaskCreate(void (*task)(void *pd),
                   void *pdata,
                   OS_STK *ptos,
                   INT8U prio);
```

In µ-cos2 kernel we can assign priorities for each of these tasks here the highest priority we can give to touch screen, and lowest to GLCD.

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. It provides typical accuracies of ±1⁄4°C at room temperature and ±3⁄4°C over a full −55 to +150°C temperature range. Low cost is assured by trimming and calibration at the wafer level.

A signal conditioner is a device that converts one type of electronic signal into another type of signal. Its primary use is to convert a signal that may be difficult to read by conventional instrumentation into a more easily read format. By performing this conversion a number of functions may take place.

They include Amplification when a signal is amplified; the overall magnitude of the signal is increased. Converting a 0-10mV signal to a 0 -10V signal is an example of amplification. Electrical isolation breaks the galvanic path between the input and output signal. That is, there is no physical wiring between the input and output. Isolation is required when a measurement must be made on a surface with a voltage potential far above ground. Isolation is also used to prevent ground loops.

Linearization is converting a non-linear input signal to a linear output signal. Many sensors require some form of excitation for them to operate. The signal conditioning unit accepts input signals from the analog sensors and gives a conditioned output of 0-5V DC corresponding to the entire range of each parameter. This unit also accepts the digital sensor inputs and gives outputs in10 bit binary with a positive logic level of +5V.

The GLCD provide the graphical display of voltage and temperature values in the monitoring section, by that we can easily understand the condition of the working station in the industry. GLCD having the inbuilt touch Screen with that by touching we can get the graph. In the remote location we have the LCD, in that we can get the values of voltage and temperature.

4. Results and Discussion

Fig3. *Master node*

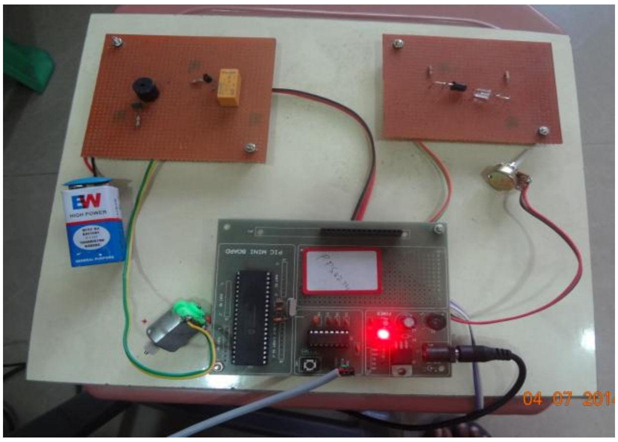

Fig4. *Data acquisition node*

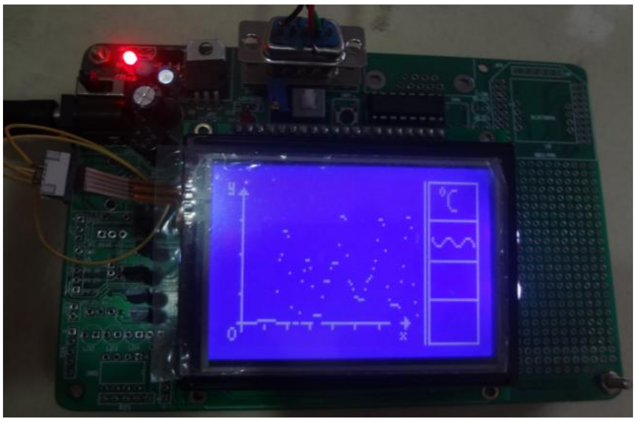

Fig5. *Display of temperature graph in GLCD*

5. Future Scope

In this paper we implemented the IWSN with multiprocessor support for industrial automation. This paper can be advanced by adding some external sensors to find out the parameters like gas, fire, etc.

6. Conclusion

This paper introduces RTOS architecture to manage the allocation of all the resources to users in an orderly and controlled manner. This paper gives the background of researchers in the field of industrial automation in real time application. The basic view of this technique is to reduce the possibility of collision and to meet the critical requirement of timing for data transmission of industrial applications.

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