International Journal of Application or Innovation in Engineering & Management (IJAIEM)
Web Site: www.ijaiem.org Email: editor@ijaiem.org
Volume 3, Issue 10, October 2014 **ISSN 2319 - 4847**

An intelligent architecture for industrial automation using RTOS technology

B.Rahul Sandeep[1], K.AmruthaVally[2]

[1]P.G Student, VRS&YRN Engineering & Technology, vadaravu road, Chirala.

[2]Assistant Professor, VRS&YRN Engineering &Technology, vadaravu road, Chirala.

ABSTRACT

This paper is an RTOS based architecture designed for the purpose of data transmission between two controlling units through IWSN without collision. RTOS is a Process which will be done 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.Stack having two techniques (PAL and NILI) we are using in the IEEE 802.15.4 to reduce the collision and timing. Mostly, during the packets transmission some collision may occur. This collision has to be avoided to prevent the data loss during the transmission. The project 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. 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.

Keywords: LPC2148, RTOS, WSN, SCADA, Graphical LCD

1. INTRODUCTION

Industrial structures consists of various small to complex systems which varies from one structure to another has been a complexity and different methods are coming to play by which Monitor and controller systems can be implemented. In such monitoring and controlling process as some systems comprise quite a huge number of tasks to be controlled from a certain common point where remote monitoring of data is processed continuously by timely manner. In such situations RTOS (Real time operating system) enables the assignment of priorities, priority inheritance, priority conversions and use of many kernel objects to ensure that tasks of high priority are executed in a timely manner. The RTOS is to manage the allocation of these resources to users in an orderly and controlled manner. 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

2. EXISTING DESIGN

Several designs have been proposed on wireless sensor networks, Real Time Operating Systems. Briefly I shall look at some of designs, Illustrate the the uniqueness of the design in relation to previous work. By using different hardware, software, operating systems and design techniques monitoring and Control has been implemented. Earlier system although provide real time monitoring and control. Faults at the sensor nodes may take longer to detect since user monitoring is done on demand and the coordinator may take longer to detect a faulty node. There is no data acquisition node and no layer Architecture However, the system has proved to be versatile in wireless sensor situations where power preservation is of prime importance. Amongst the several challenges are the issues of scalability and Timely processing. Real time processing requires that data be processed quickly since its validity is of limited duration and look over possibilities of collision.

3. PROPOSED DESIGN

The proposed system comprises a Master node controlled by a micro controller having ARM based processor. The RTOS is ported into the micro controller and control commands can be input from this node. Different sensors like temperature, voltage, fire and infrared are placed on data acquisition node, Real time temperature values, voltage levels at Data acquisition node are wirelessly relayed and also displayed on GLCD at Master node which is works on touch screen module. The Master node communicates with data acquisition node using Zigbee communication protocol. And sensors works on their basic principles individually like IR sensor alarms a buzzer when any object is detected

BLOCK DIAGRAM:

MASTER NODE

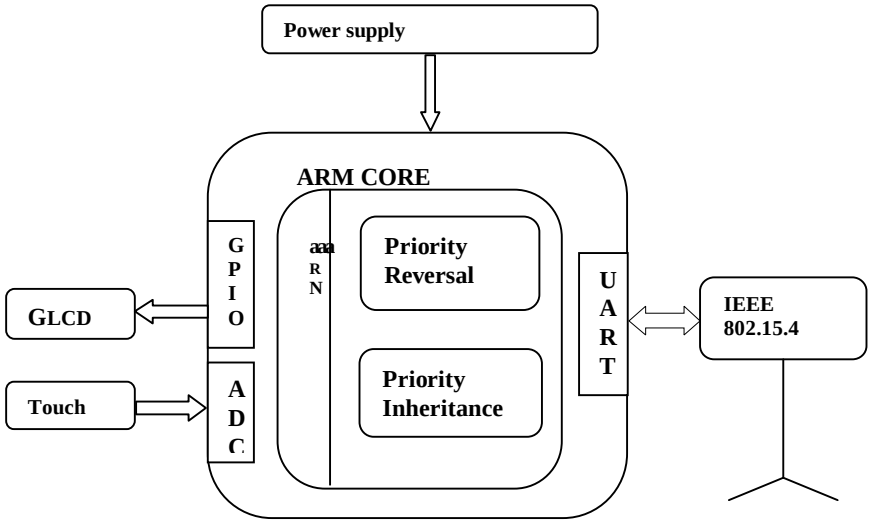

Fig.1: Master node

DATA ACQUISITION NODE:

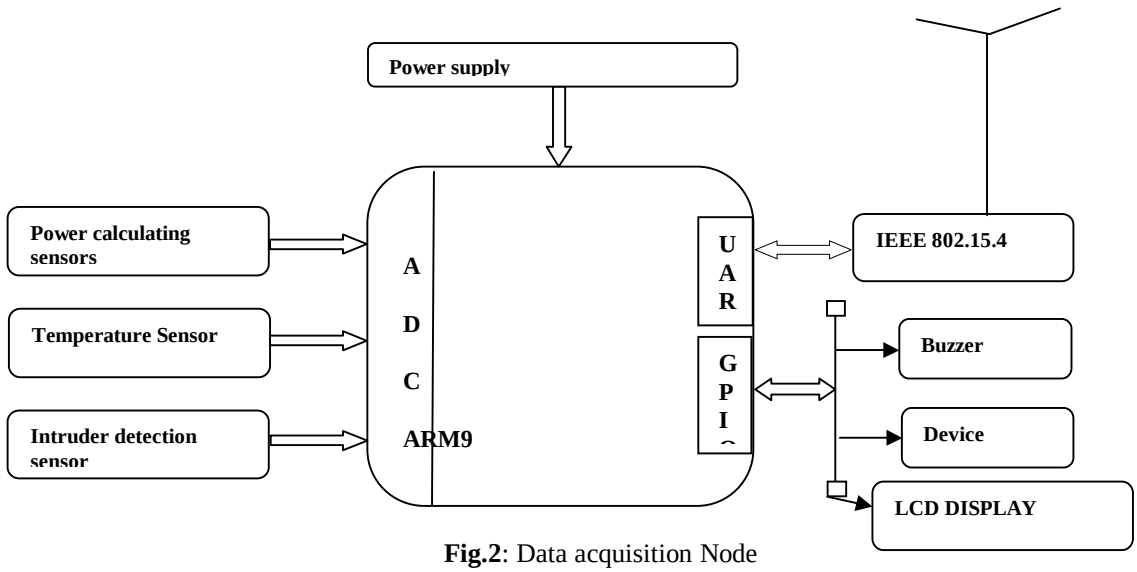

Fig.2: Data acquisition Node

3.1 TEMPERATURE SENSOR

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 ±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. 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 60µA from its supply, it has very low self-heating, less than 0.1°C in still air. The LM35 is rated to operate over a −55° to +150°C temperature range, while the LM35C is rated for a −40° to +110°C range (−10° with improved accuracy). The LM35 series is available packaged in hermetic TO-46 transistor packages, while the LM35C, LM35CA, and LM35D are also available in the plastic TO-92 transistor package. The LM35D is also available in an 8-lead surface mount small outline package and a plastic TO-220 package.

3.2 INFRARED SENSOR

IR LED at 900nm-GaAlAs Infrared Light Emitting Diode-Shines invisible IR light on the user's eye IR 900nm sensor -Light Detector -Detects reflected IR light We decided to use blinking as we wanted the device to be functional for non-vocal or ventilated users (blowing or sucking was another option). Our first idea, and the one we implemented, was to use a led/photodiode pair to reflect light off the eye. We found that Optek Inc. makes a round receiver, consisting of a LED and a photo transistor mounted on the same unit. This detected a Strong increase in signal upon blinking. We were worried about detecting the difference between normal and intentional blinks, but we found that for most users the intentional blinks produced a much stronger signal, and they were always much longer the ~300ms normal blink duration

4. GLCD WITH TOUCH SCREEN

Microcontroller Design requires many tools that allow its students to fully experience the possibilities of designing projects using Microcontrollers. In order for instructors to design laboratory experiments and demonstrations it is essential that he have the tools necessary to make them as easy to put together as possible. The goal of this project is select a low-cost graphical LCD and design a driver that would allow such experiments and demonstrations to be designed around it. In most of the experiments used for ECE 476, a 16x2 Crystalfontz Alphanumeric LCD is used as the major user output and represents the user interface. Alphanumeric LCDs display characters in pre-designated blocks and the LCD screen and this limits their use to simple number and character displays and crude images drawn from numbers or characters (a bouncing ball using the character 'o' or other such graphical techniques using text). While this is suitable for many applications, there are some which would benefit greatly from an easy to use graphical LCD. Most graphical LCDs are not supported by standard C libraries as are simple alphanumeric displays so it becomes much more time consuming to use them in projects. This can be especially prohibitive during regular laboratory experiments because they are often designed to prove a specific Instructive idea, and generating a driver for a graphical LCD cannot be done during the allotted time. This paper and project outline the design of a graphical LCD driver for the Crystalfontz CFAG12864B series (128 x 64 pixels) graphical display which can be easily modified to drive any Samsung KS0108 based graphical LCD.

5. RTOS TECHNOLOGY

RTOS is an operating system which is used to perform a task with in a particular time interval i.e. within the specific allocated time. It is a real time operating system. A real-time OS that can usually or generally meet a deadline is a soft real-time OS, but if it can meet a deadline deterministically it is a hard real-time OS. Compared with OS and RTOS, RTOS only supports the multitasking operations and time scheduling tasks. Real-time OS is the level of its consistency concerning the amount of time it takes to accept and complete an application's task. If we are implementing any task without RTOS, it is less accuracy and time delay of the specified time and normally it can possible to perform only one task at a time. So in normal operations systems perform a task one by one. So we are implementing our project using real time operating system. The multitasking is a process to perform a more than one application or task at concurrently, it means possible to perform a so many operations at the same time. in the normal operating systems are not supported this type of multitasking. so in this project we are implementing RTOS concepts. a The main advantage of RTOS is multitasking and time scheduling and rescheduling etc. In RTOS due to the internal minimum time delay of the time scheduling process it will give the output within the specified time. However, due to the lack of uniform programming model and system components for these different teams, the migrations costs of a function model from software to hardware are high. But these actions are necessary in the hardware-software partitioning of embedded systems, especially in the prototype designs. To cope with this problem, we adopt a uniform multi-task model and implement UCOS II RTOS (Real - Time Operating System).

6. WORKING PRINCIPLE

Support is an ideal system for issues related to timing integrity, the extra traffic caused by the inter layer interaction in large industries. In the existing prototype, we have noticed that, bulks of messages are transmitted between nodes so there are chances of message 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 the shared resources in real time environments, Besides the RTOS this system also provides power efficiency. 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. 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.

7. RELAY CIRCUIT

The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to operate from lower voltages. Hence a CB amplifier is used to achieve the current rating of the relay.
Transistors and ICs must be protected from the brief high voltage produced when a relay coil is switched off. The diagram shows how a signal diode (e.g. 1N4148) is connected 'backwards' across the relay coil to provide this protection. Current flowing through a relay coil creates a magnetic field which collapses suddenly when the current is switched off. The sudden collapse of the magnetic field induces a brief high voltage across the relay coil which is very likely to damage transistors and ICs. The protection diode allows the induced voltage to drive a brief current through the coil (and diode) so the magnetic field dies away quickly rather than instantly. This prevents the induced voltage becoming high enough to cause damage to transistors and ICs.

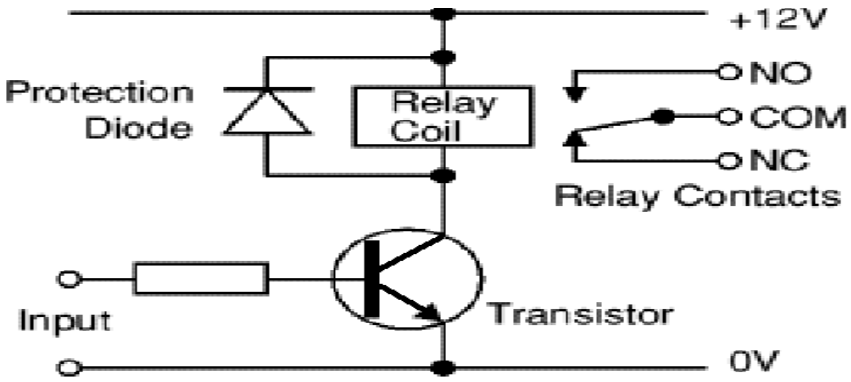

Fig.3 : Relay Circuit

8. LCD DISPLAY

8.1 LCD MODULE (2X 16 CHARACTERS).

Matrix liquid crystal {display|LCD|digital display alphanumeric display} modules are employed for display the parameters and fault condition.16 characters two lines show is employed. It's controller that interface data's and LCD panel. Liquid displays (LCD's) have materials that mix the properties of each liquids and crystals. instead of having a freezing point, they need a temperature vary at intervals that the molecules square measure nearly as mobile as they'd be during a liquid, however square measure classified along in AN ordered kind just like a crystal. AN LCD consists of 2 glass panels, with the liquid material sandwiched in between them. The inner surface of the glass plate's square measure coated with clear electrodes that outline the character, symbols or patterns to be displayed chemical compound layers square measure gift in between the electrodes and also the liquid molecules to take care of an outlined orientation angle. One every polarizer's square measure affixed outside the 2 glass panels. These polarizer's would rotate the sunshine rays passing through them to an exact angle, during a explicit direction once the LCD is within the off state, light-weight rays square measure revolved by the 2 polarizes and also the liquid, specified the sunshine rays start up of the LCD with none orientation, and therefore the LCD seems clear. Once comfortable voltage is applied to the electrodes, the liquid molecules would be aligned on a selected direction. The sunshine rays passing through the LCD would be resolved by the polarizes, which might lead to activating/highlighting the required characters.

9. TESTS AND RESULTS

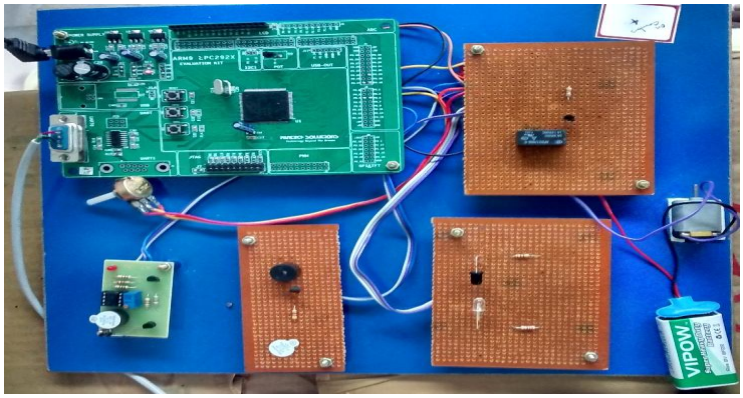

Fig.4: Data acquisition node with sensors

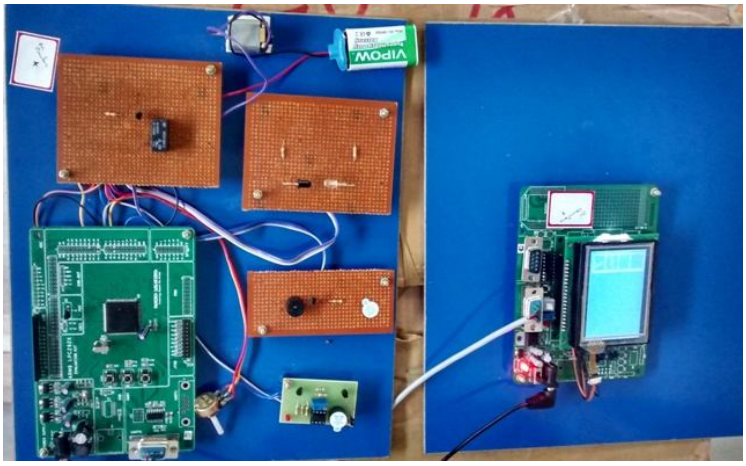

Fig.5: Master and Data acquisition nodes

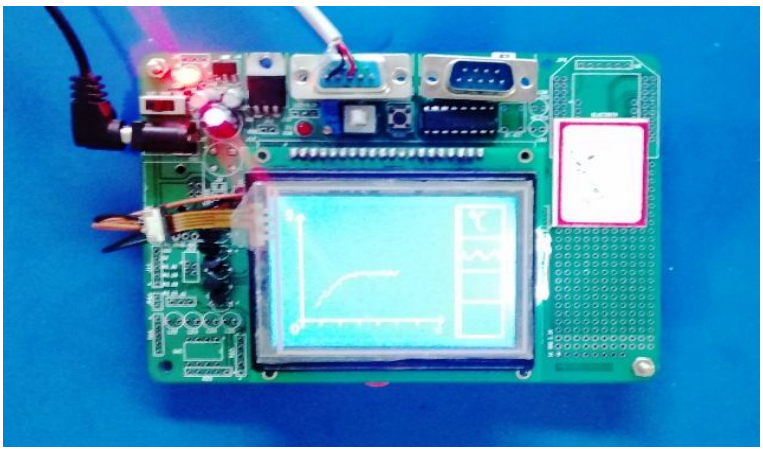

Fig.6: Master node displaying voltage levels in graphical form

The diagram in Figure 6 is a closer view showing the display of voltage levels on the GLCD in the form of a line graph and the small fluctuations in voltage values.

10. CONCLUSION AND FUTURE WORK

In this project we will add some external sensors for find out the parameters like gas, fire by using wireless sensor networks. The RTOS is to manage the allocation of these resources to users in an orderly and controlled manner. 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 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.

REFERENCES

[1] Wireless HART standard, HART Communication Foundation. www.hartcomm.org
[2] ISA100 standard, International Society of Automation. www.isa.org/isa100
[3] WIA-PA standard, Chinese Industrial Wireless Alliance. www.industrialwireless.cn/en/
[4] Akerberg, J.; Gidlund, M.; Bjorkman, M. Future research challenges in wireless sensor and actuator networks targeting industrial automation. IEEE Int. Con. on Industrial Informatics (INDIN), 2011, 410-415
[5] Xiuming Zhu; Song Han; Mok, A.; Deji Chen; Nixon, M. Hardware challenges and their resolution in advancing Wireless HART. IEEE Int. Con. on Industrial Informatics (INDIN), 2011, 416-421
[6] Edmonds, N.; Stark, D.; Davis, J. "MASS: modular architecture for sensor systems". Int. Sym. Information Processing in Sensor Networks (IPSN), 2005.393-397.
[7] Utz Roedig, Sarah Rutlidge, James Brown, Andrew Scott, "Towards Multiprocessor Sensor Nodes". ACM Workshop on Hot Topics in Embedded Networked Sensors (HotEmNets '10), 2010
[8] Chen, Deji, Nixon, Mark, Mok, Aloysius, Wireless HART™: Real-Time Mesh Network for Industrial Automation (1st ed.), Springer, 2010
[9] Jianping Song; Song Han; Mok, A.K.; Deji Chen; Lucas, M.; Nixon, M.. Wireless HART: Applying Wireless Technology in Real-Time Industrial Process Control. IEEE Real-Time and Embedded Technology and Applications Symposium, 2008, 377-386
[10] Pike OS, SYSGO AG, http://www.sysgo.com

AUTHOR

B.RAHUL SANDEEP received his B.Tech in Electronics and Communication Engineering from CHIRALA Engineering College, Chirala in 2009 and currently pursuing his M Tech in VLSI & ES in VRS & YRN College of Engineering and Technology, Chirala and his research interest in the area of Microcontroller designs, Wireless and sensor network systems and RTOS Technology.