

A Reconfigurable Sensor Network for Industrial Monitoring

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Abstract— Wireless sensor networks have been employed to collect data about physical phenomena in various applications such as habitat monitoring, and industrial monitoring, and surveillance. As an emerging technology brought about rapid advances in modern wireless telecommunication, it has attracted a lot of attention and is expected to bring benefits to numerous application areas including industrial WSN systems. The device is combined with the newest ARM7 programmable technology and the intelligent sensor specification. Performance of the proposed system is verified and good effects are achieved in practical application of WSN to industrial environment monitoring. We manually measure physical parameters in the industry like temperature, smoke and light detection which is very difficult and inaccurate. A normal person cannot show any interest to measure those physical parameters value. To avoid this difficulty we are going for our proposed system. Here is the proposed system describes the development of a wireless industrial environment measuring temperature, smoke, human detection and light detection. Where the wireless connection is implemented to acquire data from the various sensors, in addition to allow set up difficulty to be as reduced. By using Bluetooth technology we send the sensors data to authorized person.

Key words: ARM7, WSN, Intelligent Sensor, Bluetooth Technology

I. INTRODUCTION

Now a day's every system is automated in order to face new challenges. In the present days Automated systems have less manual operations, flexibility, reliability and accurate. Due to this demand every field prefers automated control systems. Especially in the field of electronics automated systems are giving good performance. In the fast growing days of technology in industrial environment, sensors plays very important role to minimize human interference.

Here is an automated smart sensor system being designed around a microcontroller which monitors by collecting inputs from different sensors. According to this project, a reconfigurable sensor network is used to monitor industrial environment continuously. Apart from this, the system also connected with Bluetooth technology which enables an authorized person get the information to regulate the conditions in industry.

Wireless sensor networks have been employed to collect data about physical phenomena in various applications such as habitat monitoring, and ocean monitoring, and surveillance. As an emerging technology brought about rapid advances in modern wireless telecommunication, Internet of Things has attracted a lot of attention and is expected to bring benefits to numerous application areas including industrial WSN systems.

II. ARCHITECTURE

This system is based on IEEE1451 protocol and by combining with ARM7 and the application of wireless communication; it is very suitable for real-time and effective requirements of the high-speed data acquisition system in WSN environment. The system achieved good effects in practical application in taking real time monitoring of industrial environment in WSN environment as an example and also more flexible and extensible. Sensors are generally restricted by the device because of the current connect number, sampling rate, and signal types and if required to connect devices required to write complicated and cumbersome data collection programming code to solve this problem this paper provides the new method i.e. design a functional smart sensor interface for industrial WSN, in this advanced risk management (ARM) is adopted as a core-controller. Fig.2 shows the proposed system i.e. Autonomic Smart Sensor Interface for Industrial Environment. This system is based on ARM and the application of wireless communication; it is very suitable for real-time and effective requirements of the high-speed data acquisition system in WSN environment.

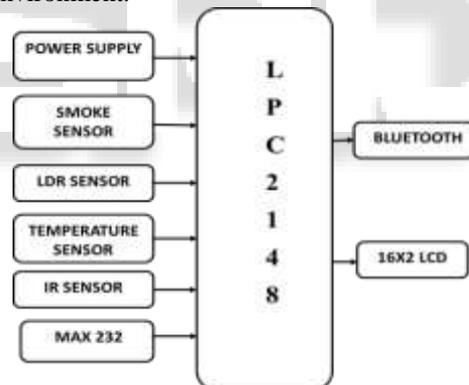


Fig. 1: System's Block function Design

This system is to develop a sensor interface device is essential for sensor data collection of industrial Wireless Sensor Networks i.e. WSN environment. In the proposed system ARM is adopted as the core controller at the time of interfacing for industrial WSN atmosphere so that it will scan information in parallel and in real time with high speed on multiple completely different device information and for this Intelligent device interface specification is adopted. Different Sensors are used to provide the values of Temperature, Smoke, Light intensity present in the industrial environment, so that critical situation can be avoided and preventive measures are successfully implemented. The result of the system gives values of Temperature. Using Bluetooth the measured values are sent from monitoring station to the controlling station and then sent via WAN to the Internet if needed. Received values are compared with the threshold value if any mismatch is found then the workers will be informed to take corrective

measures. This paper provides architecture, which enables the users to control and monitor smart devices through Bluetooth and also it creates an interface between users and smart industry by using Bluetooth. This embedded system directly connect with devices through Bluetooth network, and finally the user commands are parsed and executed by microcontroller to control any electronic objects like industrial appliances, lights, etc and it sends the acknowledgement.

III. SENSORS USED IN PROPOSED SYSTEM

A. Smoke Sensor:

An ionization smoke Detector has mainly 2 key parts: first are the ionization chamber, and a source of radiation. This has source of radiation of a very small concentration of Americium-241, which will produce alpha particles. The Ionization Chamber contains 2 plates: one plate is of negatively charged, and the other one is positively charged. The alpha particles created by the Americium-241 moves with high speed and divide into oxygen and nitrogen molecules within the ionization chamber. The force exerted by this collision makes electrons to fall off from each molecule, creating an ion. Then now positively charged ions get attracted to the negatively charged plate while the electrons get attracted to the positively charged plate. This attraction makes a consistent electrical current within the chamber. This causes disturbance in the electrical current and triggers the alarm.

B. Temperature Sensor:

The LM35 is a integrated-circuit temperature sensor, which gives output voltage which is linearly proportional to the Celsius (Centigrade) temp. So LM35 has an advantage compared to linear temperature sensors calibrated in Kelvin, as the person is not required to subtract a large const. voltage from its output to obtain convenient centigrade scaling. This sensor doesn't require any external calibrate or trim to have typical accuracies of range $\pm 1/4^{\circ}\text{C}$ at room temp and ranges $\pm 3/4^{\circ}\text{C}$ over a full -55 to $+150^{\circ}\text{C}$ temperature range. Less cost is maintained by trimming and the calibration at wafer level. It has less output impedance, linear o/p, and precise inherent calibration which make interfacing to give or regulate circuitry especially easy. It can be used in single power supplies, or in plus and minus supplies. As it takes only $60\ \mu\text{A}$ from its supply, it has very low self-heating, that is less than 0.1°C in still air.

C. LDR (Light dependent resistor):

A photo resistor or Light Dependent Resistor or CdS (Cadmium Sulphide) Cell is a resistor for which resistance decreases with increasing of incident light intensity. It can also be named to as a photoconductor.

A photo resistor is made up of a high resistance semiconductor. If light falls on the device with high frequency, photons absorbed by the semiconductor produce bound electrons with enough energy to jump into the conduction band. Thus free electron (and its hole partner) conduct electricity, result in low resistance.

D. IR Sensor (Infrared Sensor):

PIR Sensor Can find the Infrared Rays released by Human Body due to Motion within the Detection Area of 14 Mts,

and begins the Load - Light Automatically. This Unit suits for Outdoor Use (Corridor, Staircase, Courtyard, also in privacy rooms etc.)

IV. IMPLEMENTATION AND RESULT

The project has been fully verified and checked. The program burned into the ARM7 processor when plugged into the PCB is interactive with the other components already placed in the circuit.



Fig. 2: Project diagram

A. Validation:

What we wanted in the project is to have control over the extension board. At last we were finally able to control the extension board via MAX232 and ARM microcontroller. Further we will be able to connect whatever appliance we want to control by simply cabling it to extension board. The validity of the electronic components deployed in the respective circuit is reasonable and genuine to our knowledge.

B. Evaluation:

The project is aimed to design a smart sensor system through which we can monitor equipments in the industry without any manual operation. The project is developed through wireless communication of Bluetooth. The development of the project involves the interfacing of four sensors to an ARM microcontroller. We set these sensors to different machines and receive their corresponding outputs. If any problem is detected it send the signal, there by the corresponding signal passes to the controller so that the controller is an intelligent device which takes a wise decision. Likewise, the process repeats every time, to monitor the industry without human involvement. LCD is provided to display the status of the equipments.

This project uses regulated 5V, 500mA power supply. 7805 three terminal voltage regulator is used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac output of secondary of 230/12V step down transformer.

C. Result:



Fig. 3: Information sent to an authorized person

The automated smart sensor wireless technology improves the monitoring of industrial setup and helps to minimize loss and damage of equipments in the industry. Sensors continuously monitor the conditions of equipments and give its responses to ARM controller and this controller sends the information to authorized person.

V. ADVANTAGES AND APPLICATIONS

A. Advantages:

WSN sensor system brings several advantages over traditional wired industrial monitoring and control systems as expressed in the following:

- 1) **No Wiring Constraints:** Wireless sensor nodes are installed on industrial devices and equipments to monitor the measurements such as temperature, smoke level and light intensity and to transmit/receive control signals for activating the device accordingly. Without the wiring constraints, devices can be utilized in applications that previously are either physically unreachable or cost prohibitive. For example, adopting wireless transmission greatly reduces the complexity of implementing monitoring and control devices for rotary equipments.
- 2) **Easy Maintenance:** After the installation of wired device, control engineers have to deal with various wiring maintenance problems such as corrosion, water in the conduit, burned cabling, freezing, wild animal damage, physical wear caused by frequent movement of instrumentation, an unexpected power outage. Wireless device is almost care-free, only a battery change is necessary after years of operation. In addition, it is also possible to relocate current wireless devices or deploy additional wireless devices on the control system after it has been installed with minimal changes to the existing configuration.
- 3) **Reduced Cost:** Cabling and installation for an automation project in an existing facility can run as high as 80% of total system cost and can exceed \$1,000 per linear foot in regulated environments, like a typical power plant. Going wireless eliminates the wiring, conduit and installation cost. What's more, for some applications, sensing nodes can put their radio in off mode when necessary, this will save lots of energy compared to wired devices, which requires constant power supply.
- 4) **Better Performance:** Industrial WSNs have the potential to outperform the existing process control network with wired devices. Firstly, it has higher data transmission speed. Secondly, unlike wired control systems, where devices share a single bus, multiple wireless communications can act simultaneously if there is no mutual radio interference. Thirdly, more sensors/data points can be used to beat the performance of traditional wired control system.

B. Applications:

- Hotels and restaurants.
- Industries and Business environments.
- Multi starred buildings.
- Wherever the automated systems are required.

VI. CONCLUSION

This paper describes a reconfigurable smart sensor interface for industrial wireless environment. The system can collect sensor data intelligently. It was designed by combining with ARM and the application of wireless communication. It is very suitable for real-time and effective requirements of the high-speed data acquisition system in wireless environment. The application of ARM greatly simplifies the design of peripheral circuit, and makes the whole system more flexible and extensible. Different types of sensors are used and are connected to the system. Main design method of the reconfigurable smart sensor interface device is described in this paper.

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