

A Wireless Surveillance and Safety System for Mine Workers based on ZigBee

^{#1}Prof. Dr.S.L.Lahudkar, ^{#2}Gawande Krutika, ^{#3}Danane Neha, ^{#4}Guthe Roshni

²gawandekrutika@gmail.com
³dananeneha20@gmail.com

^{#1}Prof. Department of Electronics and Telecommunication
^{#2,3,4}Department of Electronics and Telecommunication

JSPM Imperial College Of Engineering. And Research, Pune.



ABSTRACT

With continuous enlarging of exploiting areas and extension of depth in coal mine, many laneways become monitoring blind areas, where are lots of hidden dangers. Moreover, it is inconvenient to lay cables which are expensive and consume time. In order to solve the problems, we designed a mine safety monitoring system based on wireless sensor network, which can improve the level of monitoring production safety and reduce accident in this work. Zigbee technology provides a direction for scientists who commit to solve the safety monitoring problems. We have proposed a low-cost solution to enhance the remote monitoring capability of existing industrial system. It is secure, robust and low-power consuming. It can also operate on multiple channels so as to avoid interference with other wireless devices or equipments in the industry.

Keywords: Zigbee, Mine Safety, Wireless Surveillance

ARTICLE INFO

Article History

Received :3rd March 2016

Received in revised form :
4th March 2016

Accepted :6th March 2016

**Published online : 9th
March 2016**

I. INTRODUCTION

Each of past three centuries has been dominated by a single technology. The 18th century was the era of the great mechanical system accompanying the industrial revolution the 19th century was the age of the steam engine. During the 20th century the key was information gathering, processing & distribution. among other developments we saw the installation of worldwide telephone networks, the invention of radio & television, the birth and unprecedented growth of computer industry, the launching of communication satellite. As a result of rapid technological process, these areas are rapidly converging and the difference between collecting, transporting, storing, and processing information are quickly disappearing .Organizations with hundreds of offices spread over geographical area routinely expect to be able to examine the current status of even their most remote outpost at the push of the button. As our ability to gather, process and distribute information grows, the demand for ever more sophisticated information processing grows even faster.

Now a days in industries automation is done. Each and every unit is controlled by a single computer. In each unit

everywhere sensors are placed and these sensors are interfaced to the controller. and according to instructions controller performs operations. This can be done using wired or wireless technologies. In wireless we have Bluetooth but they have some drawbacks like short range, high cost, power consumption is more etc. To overcome these drawbacks here we proposed a system which named as "Zigbee based sensor network". This is the integration of wireless technology and sensor network. The project is mainly targeted towards the reliability of the Industrial system.

ZigBee is an open technology developed by the ZigBee Alliance to overcome the limitations of BLUETOOTH and Wi-Fi. ZigBee is an IEEE 802.15.4 standard for data communications with business and consumer devices. It is designed around low-power consumption allowing batteries to essentially last forever. BLUETOOTH as we know was developed to replace wires and Wi-Fi to achieve higher data transfer rate, as such till now nothing has been developed for sensor networking and control machines which require longer battery life and continuous working without human

intervention. ZigBee devices allow batteries to last up to years using primary cells (low cost) without any chargers (low cost and easy installation).

In this project we monitor the temperature, pressure and DIP switches for turning on the light. These all are interfaced to PIC controller. One ZigBee transceiver is also connected to controller through SPI. At the control room same set up will be installed instead of sensors we will connect PC to controller using RS232. All measured parameters are display on PC.

II. LITERATURE SURVEY

“Integrated Mine Safety Monitoring and Alerting System Using Zigbee & Can Bus”

In This paper, the implementation of integrated mine Safety monitor system is explained. The system is composed of PC monitors, sink nodes, base station nodes and mobile nodes. This mine safety monitoring system based on wireless sensor networks, and hardware and software design of wireless sensor network are described in detail, this system can detect concentration of the gas, temperature, humidity, wind speed and trace the location of miners in underground mine tunnels. Wireless sensor networks applied in monitoring coal mine security breaks through the traditional methods and ideas, which improves the practical ability and flexibility of monitoring system. This system not only can monitor all kinds of parameters under the coal mine, but also can alarm automatically when environment parameters are abnormal to exceed the limitation, which help improve the level of monitoring safety production and reduce accident in the coal mine.

“Application Of Wireless Sensor Network In Coal Mine Safety Monitoring System”

In this paper, For Demonstration purpose we used the sensor. The MQ7 gas sensor is more sensitive to the carbon monoxide but can sense methane, butane, LPG, hydrogen, smoke etc. He found more heating of sensor if operated for long time. The ZigBee communication is noise free. ZigBee and LPC2148 provides low power platform. More advanced Version of controller like cortex-M3 can be used for more speed of execution and extreme low power consumption. With the use of sophisticated sensors, the system can work with more accuracy in real time. It can be modified in industrial monitoring as well.

“Multiple Fire Sensors for Mine Fire Detection And Nuisance Discrimination”

In this paper he define and proposed To determine the effectiveness of multiple types of fire sensors forearly and reliable mine fire detection.

“Underground Coal Mine Monitoring with Wireless Sensor Networks”

In this article, he discuss SASA, a Structure-Aware Self-Adaptive wireless sensor network system, for underground monitoring in coal mines. By regulating the mesh sensor network deployment and formulating a collaborative mechanism based on the regular beacon strategy, SASA is able to rapidly detect structural variations caused by underground collapses. The collapse holes can be located and outlined, and the detection accuracy is bounded. We

provide a set of mechanisms to discover the relocated sensor nodes in the hole region. We further provide a robust query handling approach for unstable network conditions. The proposed signature file-based approach explores the multi-path effect in the network and performs accurately and efficiently.

III. PROPOSED SYSTEM

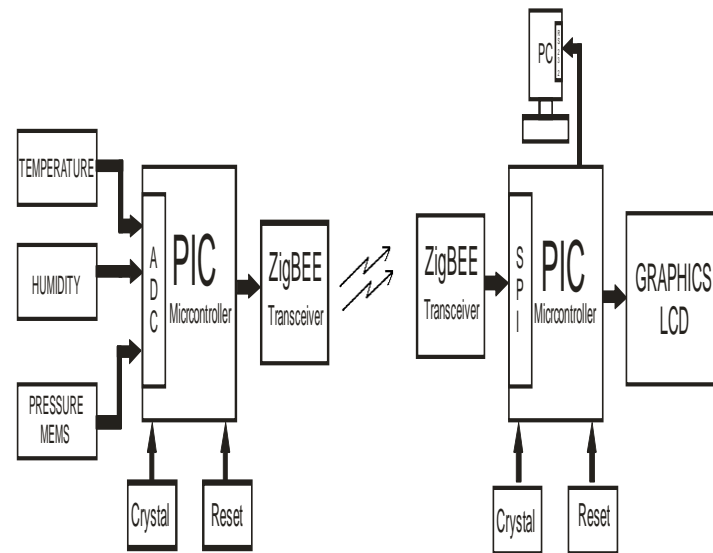


Fig 2. General Block Diagram Of Zigbee Based Sensor Network

The generalized block diagram of Zigbee based sensor network is shown as above. The block diagram can be divided into two parts first one is Master and second is slave. Master consists of following block:-

- PIC microcontroller
- Zigbee module
- Power supply
- PC

Similarly slave consists of following blocks:-

- PIC microcontroller
- Zigbee module
- Power supply
- Temperature sensor
- MEMS (pressure sensor)
- DIP switches

For the communication we require

- RS 232
- SPI

The parameters which we want to measure are physical parameters (i.e in non –electrical form).so as to convert it into electrical form we are using sensors. The output of sensor is in analog in nature to convert it into digital form we apply it to ADC which is inbuilt in PIC controller. The converted digital output of sensor is analyzed by controller for taking proper action. After that controller ask Zigbee module it is ready or not. Then controller sends these data through SPI to Zigbee transceiver .The information is send to master module. It will receive it and decodes it. Then give it to PIC controller and according to information is received,

will display on PC. Likewise information will be updated after every fixed duration.

If we want to switch of any process for example if temperature is more than set point then master will send command to slave to switch of the process. In this way bidirectional communication takes place. And we can get status of each sensor, switch on one pc. Also we can control it also.

IV. APPLICATION AND ADVANTAGES

Applications:

- **Home Entertainment and Control** — Smart lighting, advanced temperature control, safety and security, movies and music
- **Home Awareness** — Water sensors, power sensors, smoke and fire detectors, smart appliances and access sensors
- **Mobile Services** — m-payment, m-monitoring and control, m-security and access control, m-healthcare and tele-assist
- **Commercial Building** — Energy monitoring, HVAC, lighting, access control
- **Industrial Plant** — Process control, asset management, environmental management, energy management, industrial device control

Advantages:

- Low cost
- Low power consumption
- Using one PC whole plant can be monitor
- Real time monitoring

V. CONCLUSION

We have proposed a low-cost solution to enhance the remote monitoring capability of existing industrial system. It is secure, robust and low-power consuming. It can operate on multiple channels so as to avoid interference with other wireless devices or equipment's in the industry.

REFERENCE

- [1] Chonggang Wang and Kazem Sohraby, Rittwik Jana, Lusheng Ji, and Mahmoud Daneshmand, Voice Communications over ZigBee Networks, IEEE Communications Magazine, January 2008, 0163- 6804/08.
- [2] Andrew Sloss, Dominic Symes, Chris Wright, ARM System Developer's Guide, 2004, Morgan Kaufmann, ISBN: 1-55860-874-5.
- [3] UM10139, LPC214x User manual, NXP Semiconductors, Rev. 4 — 23 April 2012.

[4] ZigBee Specification Document 053474r17, January 17, 2008, ZigBee Alliance.

[5] Technical datasheet MQ-7 Gas Sensor HANWEI ELECTRONICS CO., LTD

[6] Vaibhav Pandit, Prof U.A Rane, || Coal mine monitoring using ARM7 and ZigBee ||, IJETAE, 2012

[7] MDK-ARM, KeilTM Tools By ARM, Keil0223-3\01.11J.S.

Books:

[1] "BASIC for PIC Microcontrollers" Nebojsa Matic

[2] "Microcontroller Programming the Microchip PIC" Julio Sanchez, Maria P. Canton

[3] "PIC Assembly Language for the Complete Begin" Michael A. Covington.