Technical Review on Development of A WSN Framework for Mining & Civil Safety Monitoring Purposes

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Abstract: *In this paper we describe the development of an IEEE 802.15.4 compatible wireless sensor network (WSN) node for mining & civil safety protocols. The sensor node will acquire and internally store data of sensors periodically. Starting times as well as the time intervals for the measurements can be freely programmed over the network system. As soon as an obstacles is detected in its proximity the node will automatically transfer data. Optionally sensor data can be delivered on demand. When in its idle state the node remains in power-down mode in order to minimize power consumption. Secondly attempt can also be make in this work that to generate the alerts as per settable range of unhealthy conditions.*

In normal Industrial data transfer environments standard current loops of 4mA-20mA or standard voltage loops of isolated 12V, 24V & 36v are used. But all these methodologies are associated with the long distance & short distance wired topologies. As wired communications are costly & needs the frequent maintenance cost appointments their forms the need of development of suitable profile with suitable data rates. The profile here developed form the unique wireless link using Wireless for such inter analog & digital data transmissions.

Keywords*: wireless sensor network, mine safety, network topology, zigbee*

I.   Introduction

Mining/civil automations which are mostly depend upon the power systems & which requires distance controlled and regulated systems. Mostly voltage and current equipped parameters along with power and energy management system forms the industrial scenario for automations. Wired system with analog and digital control systems have traditional drawbacks influenced by distance communication techniques. These systems are also sustainable for early noise effects and data corruptions, due to which some unexpected behavior may occur in power system which again may lead to serve effect like production failure; secondly development cost for such system again hits the cost performance ratio in adverse mannerism.

To overcome & conquering to such unhealthy and miserable functioning properly managed wireless system will always prove to be gift hand for industry.

In the recent research field which focused on numbers of wireless technologies, a technology which meets to cost, speed and distance scenario will always be a point of an interest for research. Standardization of technology again plays an important role for globalization of these profile developments. Wireless due to its standardize operational and network management properties will be suitable wireless interface technique, Wireless also have low data rates over a middle distance and AES encryption properties which are again guaranteed for required communication scenario.

In this Project work we will mainly monitor power related parameters with temperature & distance level and enable remote switching devices for proper power management systems, part of research also employ multi switching properties in order to cost redundancy with reduce network management efforts.

II.   Literature Review

Jieun Jung & Byunghun Song(2014) [1] WSN based pipe rack safety monitoring system uses ISA100.11a standard. They designed the system consisting of field nodes, field network gateways, control server and evaluated its operation at large scale petrochemical plants. Here the data obtained from WSN based safety sensors, which proves that the system can continuously monitor and evaluate structural stability of pipe rack, provide risk management guidelines based on real world measurement. This system is helpful in detecting hazardous conditions in industries before they posses any risk.

Pranoti Anandrao Salankar, Sheeja S. Suresh (July-Aug2014)[2] Coal mines parameters such as carbon monoxide, temperature, water level has monitored with the help of Zigbee technology. This system is proposed for making decisions for protection of miners. This   system collects data and accordingly inform workers through different alarm tones and LED display system.

S.Vandana, V.B.Sundheep (May 2011) [3] This system helps for monitoring temperature, humidity, and gas values of coalmine at underground and ground sections, and stores this data in PC. It also counts number of persons inside mines with the help of IR sensor. In case of any hazardous conditions occur, this system will warn persons inside mines by buzzer. The person who is unable to come out of the mine will use oxygen helmet and other persons will take proper actions to bring him out safely.

Tanmoy Maity , Partha sarathi Das , and Mithu Mukherjee(June-December, 2012)[4] This system provides continuous monitoring for underground mine worker's protection and safety. This module is based on MEMS based sensors. This system has two parts; first part is hardware circuit attached to body of the workers, generally on the helmet. And second part is ground control centre computer system. The communication system is based on the Zigbee.

N. Krithika and R. Seethalakshmi(August 2014)[5] This work proposes a safety scheme for coal mining industry using sensors and zigbee. The zigbee built safety scheme with precise remote monitoring and tracking is the most suitable life saving system for underground mining environment. The LPC2148 based underground sensor module continuously monitors and transmits data to the tracking module using zigbee. The PIC protective device wore by labor helps to identify their location using zigbee and the associated limit switch alerts labor in case of improper wearing of PPE. The voice unit attached to underground sensor module gives an emergency command based on the analysis of monitored parameters. In addition the tracking module helps to locate workers through the signal relayed by zigbee protective device. Thus the safety system for coal mining regions with ability to track and alert via voice command forms a complete protective system for underground labors.

Shilpa Lande, Prof.Matte P.N(September 2015)[6] Motivation for better development of communication infrastructure comes form coal mine accident. At the time of emergency accurate information of the environmental condition should provide with great ease to the rescue team & this can be achieved by proper communication. This paper discusses continuous monitoring of underground coal mine parameter like gases, temperature, humidity & vibration. The various parameter information is sensed, collected and stored in microcontroller (ARM 7) using respective sensor. All this information sends towards monitoring section. In the monitoring section there is one GUI created. Decision is taken accordingly through which mine worker are informed through buzzer. One of the applications of WSN that is Zigbee protocol, IEEE 802.15.4 standard is used for communication. The communication between hardware circuit in coal mine and administrator done through the Zigbee. This system is adaptive & highly beneficial for rescue & protection.
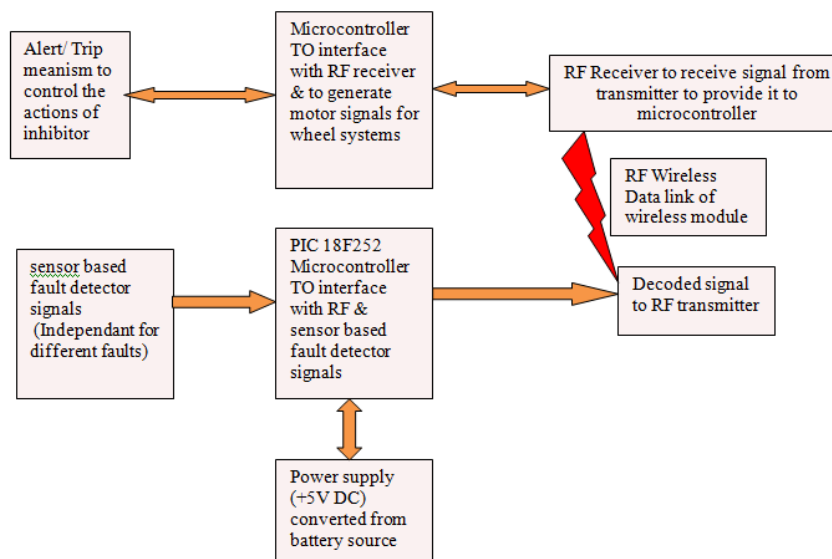
III. Proposed Methodology

Fig.1. Basic block diagram of proposed system

The proposed project research work is mainly focused on to satisfy the basic needs of fault data transfer & communications . As in normal Industrial data transfer environments standard current loops of 4mA-20mA or standard voltage loops of isolated 12V, 24V & 36v are used. But all these methodologies are associated with the long distance & short distance wired topologies. As wired communications are costly & needs the frequent maintenance cost appointments their forms the need of development of suitable profile with suitable data rates. The profile here developed form the unique wireless link using Wireless for such inter analog & digital data

transmissions. The proposed project research work keep the model in which remote PLC control industrial machineries will be controlled & regulated by the switching actions performed by FFD side. This FFD side also displays the status of the RFD side system on the LCD connected on its panel. Alarm & Indications as shown that corresponds to status monitoring effects on server side due to remote mining/civil parameter dependency.

The sensor node will acquire and internally store data of sensors periodically. Starting times as well as the time intervals for the measurements can be freely programmed over the network system. As soon as an obstacles is detected in its proximity the node will automatically transfer data. Optionally sensor data can be delivered on demand. When in its idle state the node remains in power-down mode in order to minimize power consumption. Secondly attempt can also be make in this work that to generate the alerts as per settable range of unhealthy conditions.

IV. Conclusion

Wireless has a lot to offer wireless fault transfer for mining/civil applications because of low cost deployment and redeployment, mesh networking to cover entire industrial plants and factories, open standard with multiple vendors, battery operation. As we are implementing this project for display & all necessary data transfers, this project form the wide scope to utilize wireless for improve control & operations. With the development of different Gateways this project can be further used for forming the different web servers & can be employed to DBMS. Previously designed systems uses sensors on helmets or on the wrist of the workers. But we are using unmanned vehicle, it will be possible to have alert generation before any hazard. And it will be effectively useful for fault data transfer.

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