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## AN INTELLIGENT WIRELESS SENSOR NETWORK FOR COAL MINING SYSTEM

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**Abstract:** In this paper, we depict our experiences using a remote sensor framework to screen coal mining. Multi-sensor in a center point can get a mix of common data, including the vibration of the mine, the temperature of the mine, the wetness and gas center, and the ordinary parameters of the fan. There are diverse remote sensor center concentrations in the structure. The Mine Safety Monitoring Program was made to save the got data from the sink center centers, to show up capably, and to ask pretty much the majority of the information beyond what many would consider possible. Concentrating on potential flares in coal mine age, this paper proposes a coal mine fire watching structure subject to Zig-Bee improvement and looks at organize data transmission in the system. Accurately when the system is applied to an authentic coal mine, it achieves a sound fire watching impact. The Wireless Sensor Network (WSN) coal mine fire checking structure contains three subsystems, the Data Acquisition Subsystem, the Control Center Subsystem and the Emergency Response Subsystem. As a key unit of sensor center centers, the WSN is detached into five regions: the sensor module, the treatment module, the remote correspondence module, the district module and the power supply module. The structure can screen air temperature, splashed quality and smoke centers in a coal mine and give an influencing inspiration to the watching unit to pick decisions on fire evasion and control measures. An on zone watching test shows that if there should develop an occasion of a fire, the WSN can sufficiently screen the fire plan in the coal mine, reflect the temperature task in detail, and positively issue alerts. This decision gives hypothetical outcomes to the improvement of coal mine fire watching progress..

**Keywords:** Raspberry Pi Board (ARM11), X-bee wireless communication, IoT, Ethenet, Sensor data acquisition, LINUX OS

### 1. INTRODUCTION

Prospering is a tremendous development in various affiliations. In any risky work environment, human life security is a fundamental concern, and rejecting the achievement part can deter the formation of astounding mechanical gathering or even in remarkable cases may achieve loss of human

life. Achievement and security are a desperate part in the burrowing industry for all. All digging industry searches for after some principal thriving measures and sign to check any unfortunate sign. Correspondence is a fundamental piece of the present seeing of various parameters and comprehending how to

expel any potential threats related to creation, security and human resource the board. A trustworthy, unending and strong correspondence structure, close to prospering and security, is basic to shield material accident and human accomplishment from being lost in inside the underground coal mines. To extend achievement, security and favorable position in underground coal mines, a trustworthy correspondence structure must be made between workers, moving into the mine, and having a fixed base station. For explicit reasons, it is difficult to display a wired correspondence system inside the mines after substantial slides are broken or hurt. If some wire of the correspondence framework is hurt with no legitimate reason, it may cause a short bothering of the immovable methodology or a whole plan breakdown of the structure. To improve the security of life, various structures have been arranged and recognized today in unequivocal countries and various countries need to develop a flourishing system around the globe.

## EXISTING SYSTEM

At present, the coal mine gas watching structure is usually made out of a checking sensor, an underground unit, a correspondences system and a surface station. The convergence point between the underground substations with the surface focus makes the correspondence system, which truly impacts the transmission quality and the endeavor cost of the structure. The correspondence system can be disengaged into three sorts as demonstrated by their structure: winding, circumlocutory, tree. The tree structure is genuinely generally used by coal diggers, while a substation is connected with a couple checking sign to diminish system branches, and all substations are joined to a near structure

interface, which starts from the reason for get together of the surface with underground substations in a position of indistinct watching limit.

## PROPOSED SYSTEM

We have now proposed a pushed remote structure for coal mines to reestablish the ground state of the coal mines to the ground station by sending information instantly on the coal mine application running on the grasped person's Android phone.

## II.SYSTEM ARCHITECTURE

HELMET SECTION:

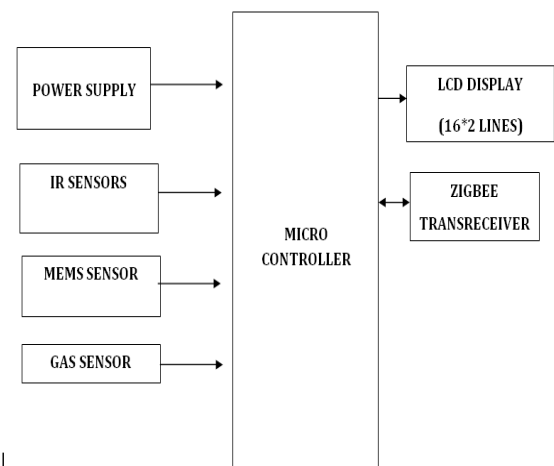


Figure: Block Diagram

MONITORING SECTION:

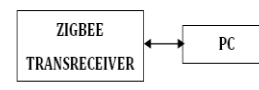


fig 3.2 Block Diagram Description

The LPC2148 microcontroller weight up, in context on a 16-piece/32-piece ARM7TDMI-S CPU with ceaseless imitating and inserted seek after help, accomplices microcontrollers from 32

KB to 512 KB with brisk glimmer memory. The 128-piece wide memory interface and interesting restoring pro design empower 32-piece code execution at most phenomenal clock rate. For complex code size applications, the elective 16-piece thumb mode diminishes the code by over 30% with a base presentation discipline. LPC means low power irrelevant effort microcontroller. It is a 32 piece microcontroller made by Philips Semiconductors (NXP). Because of their little size and low power use, the LPC2148 is perfect for applications that require scaling back, for example, get the chance to control and explanation behind offer. The LPC2148 highlights 512 kB streak memory framework, freely. This is utilized for both memory code and information putting away. The programming streak memory can be penetrated from alternate points of view. It will as a rule be changed into structure through sequential port. Impact can be executed or changed while the application program is running, permitting fundamentally progressively significant adaptability for information putting away field firmware revives. In perspective on the favored compositional reaction for the on-chip boot loader, streak memory is open the client code in LPC2148 is 512 kB freely. LPC2148 Flash memory gives in any event 100,000 periods/make cycles and 20 years of information support. The register module needs to be used by organizations that want to substitute the new object's progress pattern, i.e. create a baseboard with the appropriate peripherals, while the compute module gives the CPU, memory and capacity the CPU, memory and capacity.

The rest of this paper is organized as follows. The architecture is presented in Section II, and detailed hardware and software implementations are described in Section III. The application in

water quality monitoring is discussed in Section IV. Finally, we conclude our work in Section V.

## III.HARDWARE IMPLEMENTATION

### 3.1. LPC2148 controller

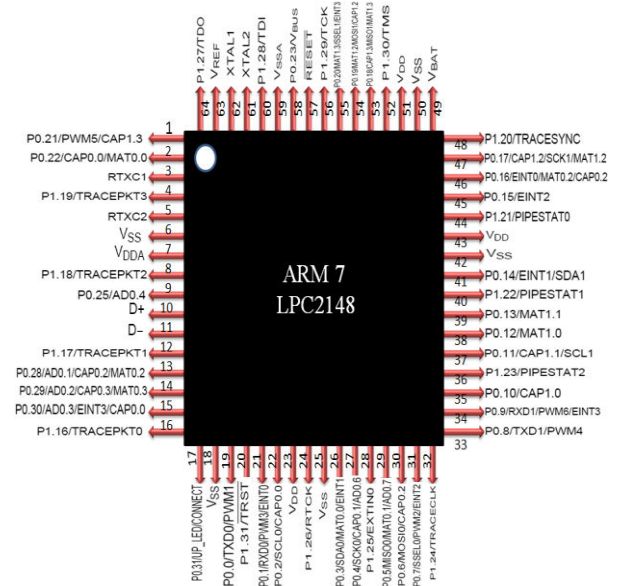


Figure: LPC2148

The ARM7EJ-S processor is a blend focus that gives most of the benefits of ARM7TDMI - low power usage, irrelevant and thumb course set - enabling the reviving of Java-based applications, including ARM's latest DSP progressions. Unprecedented with ARM9™, ARM9E and ARM10™ families, and Strong-Arm Architecture Software made for the ARM7TDMI processor is 100% parallel faultless with various people from the ARM7 family and is ARM9, ARM9E and forward-immaculate

### 3.2. Zigbee wireless communication

The wireless sensing units with internal sensors to measure temperature, light, humidity, electrical parameters, etc., are deployed at the house as shown in Fig. 3. Electrical sensing units are fabricated in such a way that they can be easily plugged into power points and can operate according to their functional characteristics



within an indoor range of about 70-80 meters provided an XBee S2 Pro module is used. We considered Xbee-S2 modules in the present setup as they provide sufficient indoor range (i.e. up to 40 meters).

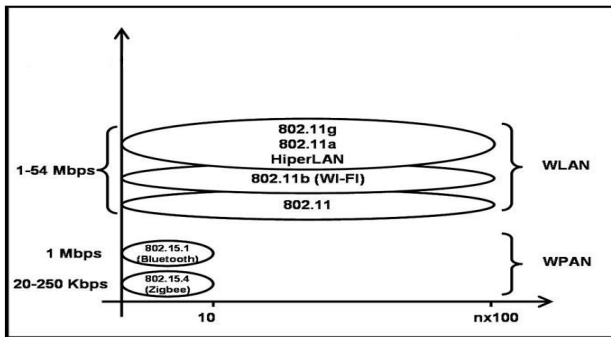


Fig4.2 Various Wireless Technologies

### 3.3 IoT Application Gateway -Address Transformation

The key element in the data transformation from ZigBee to IPV6 format is the address translation. This was implemented by the application gateway program for determining the source or destination address of a packet that encapsulates a ZigBee packets' payload. The corresponding application gateway performs the address transformation mechanism for ZigBee to address non ZigBee nodes. ZigBee is based upon the 802.14.5 protocol which uses a 64 bit address for each node on a PAN, and 16 bits to identify the PAN ID. IPv6 uses 128 bits to address a node on the network, of which 48 bits represent the network, 16 bits represent the local network (PAN ID), and 64 bits represent the host id (sensor node). Therefore, the node address for 802.15.4 can be placed in an IPv6 address, and the PAN ID can be used to identify the ZigBee network in an IPv6 address.

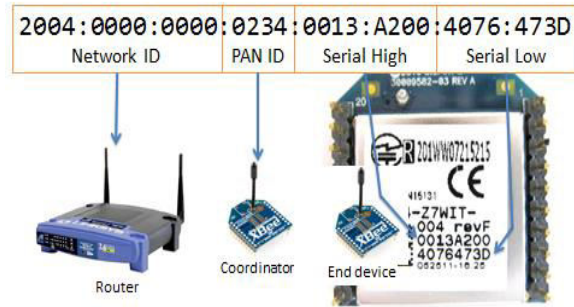


Figure : Address transformation from ZigBee sensing unit to Internet Packet

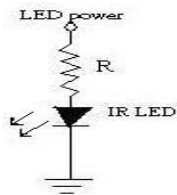
### 3.3. Sensor Characteristics

A sensor is a device that measures the physical size and converts it into a signal that can be read by the observer or device. For example, a mercury-glass thermometer converts the measured temperature into liquid expansion and contraction, which can be read in a calibrated glass tube. When selecting sensor the parameters such as its scope, capacity, cost, impact, etc. are considered.

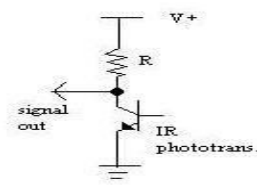
### IR producer and IR phototransistor

The infrared producer is a LED conveyed using gallium arsenide, which discharges infrared centrality at about 880nm. The infrared phototransistor goes about as transistor with base voltage interminable inventory of light that hits the transistor. From this time forward, it goes about as factor current source. A huge amount of IR light courses through power producer leads. The phototransistor is wired in course of action like the voltage divider, as appeared in format underneath. IR snappy sensors have an arranging infrared transmitter and infrared gatherer pair. These contraptions work by assessing the degree of light reflected in the gatherer. Since the position other than responds to consolidating light, it works best when device is all around

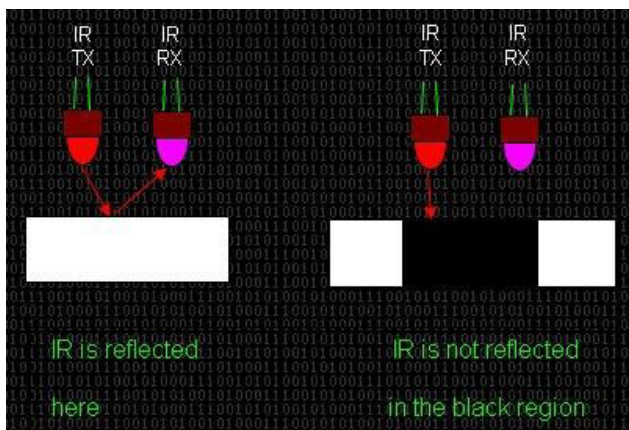
shielded from light and when division between the sensor sharp surface is close to nothing (Lestan 5 mm). IR sharp sensors are conventionally used to see white and diminish surfaces. White surfaces all around reflect well, while dull surfaces reflected.



An IR emitter



An IR phototransistor



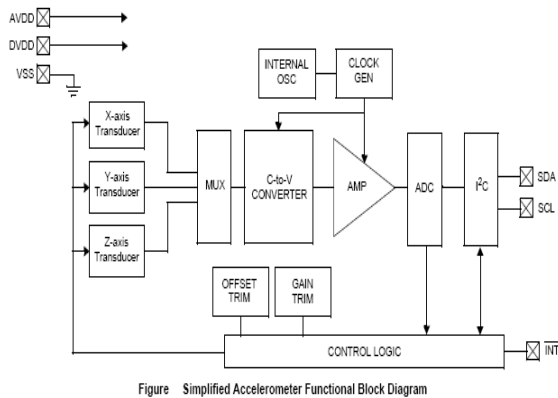
## Gas Sensor

Gas sensor is a simple to-use LPG sensor, sensible for seeing LPG (made out of generally propane and butane) obsessions noticeable all around. The MQ-6 can see gas accumulates some spot in the degree of 200 to 10000ppm. This sensor has a high affectability and brilliant response time. The sensor's yield is a basic restriction. The drive circuit is clear. Fragile material of MQ-6 gas sensor is SnO<sub>2</sub>, which with lower conductivity in clean air. Absolutely when the target burnable gas exist, the sensor's conductivity gets higher close to the gas center rising. Customers can change over the capability in conductivity to relate posted notice of gas center through a prompt circuit. MQ-6 gas

sensor can see sorts of flammable gases, especially has high affectability to LPG (propane). It is a kind of ease sensor for explicit applications.

## MEMS

(MEMS) are immaterial energized devices or structures that interface electrical and mechanical parts. Their size can associate from sub micrometer (or sub micron) level to millimeter level and can be any number from few to millions unequivocally structure. MEMS expand the creation methodology passed on for shaped circuit industry to meld mechanical parts, for instance, bars, riggings, stomachs and springs. Occasions of MEMS device applications merge inkjet-printer cartridges, accelerometers, cut back scale robots, little scale engineers, locks, dormancy sensors, humbler scale transmissions, more diminutive scale mirrors, progressively small scale actuators, optical scanners, fluid siphons, transducers and radiators, and siphons. With the utilization of current movement to downsizing and blend of standard contraptions, diverse new applications are rising. MEMS isn't about any one application or contraption, nor is it portrayed by single creation system or obliged to unequivocal materials. They are creation instrument that systems focal reasons for reducing, different bits and microelectronics for structure and movement of empowered electromechanical structures. MEMS isn't just about downsizing of mechanical systems, yet what's more new game-plan for the structure of mechanical contraptions and systems.



Simplified Accelerometer Functional block diagram

## V.EXPERIMENTAL RESULTS

This humbler than normal model board relies on the High-Performance Circuit Board (ARM7). The structure joins sensors, spread and sensors in wary tops to screen infrared in the coal business. If there should be an occasion of any event in the mine, defensive tops accommodated the checking station by Zigbee Transmission and Control Stations masterminded coal diggers using ZigBee to get the latest seconds on the head defender, so excavators can extra lives. When you turn on lights and all contraptions are associated. The position sensors' film is composed X-(a man with defensive top).

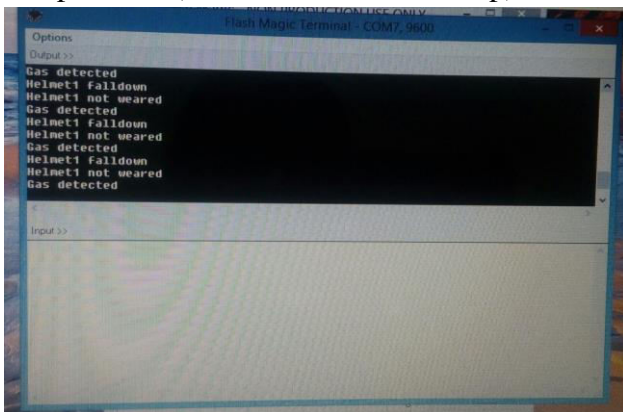


Fig. The IR, Gas Sensors Measurement Result

## VI.CONCLUSION

In Coal mine checking structure subject to Zig-bumble bee movement, and exchanges about the framework data transmission process in the system. Applied to a dependable coal mine, the system achieves a sound fire checking impact. The terminations are according to the going with: (1) The proposed WSN coal mine fire watching structure contains three subsystems, expressly data checking subsystem, control center subsystem and emergency response subsystem. With sensor center concentrations as the basic unit, the WSN contains five zones: sensor module, treatment module, remote correspondence module, region module and power supply module. The structure can screen the air temperature, wetness and smoke get-together of fire in the coal mine, hence giving fitting inspiration to watching division to pick decisions burning dodging and control measures.

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