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DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

PRESENTATION ON

MINE SAFETY SYSTEM USING INTERNET OF THINGS (IOT)

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INTRODUCTION

- Safety is the most vital part of any type of industry. In the mining industry safety and security is a fundamental aspect of all.
- To avoid any type of accident mining industry follows some basic precautions. Still, accidents take place in underground mines due to rises in temperature, increased water levels, and different gas leakage. Such vital parameters must be continuously monitored using sensors such as LM35, water level indicator, gas sensor, and fire and to take necessary actions accordingly to avoid any types of further hazards.
- To enhance safety in underground mines, a reliable communication system must be established between workers in underground mines and fixed-ground mine systems.

NEED OF PROJECT

- The need for mine safety systems is to protect the health and safety of miners working in underground or surface mining operations. Mining can be a dangerous and high-risk activity due to the presence of hazards such as fire explosions, toxic gases, the rise of water levels, and temperature. The use of advanced safety technologies and systems can help to minimize the risk of accidents and injuries in mines.
- Mine safety systems are designed to monitor and control various aspects of mining operations. They can also include early warning systems by alerting the miners to take necessary precautions or evacuate the area.
- It reduces the complexity of the underground mine environment.
- Overall, the need for mine safety systems is crucial to ensure the well-being of miners and to prevent accidents and injuries in the mining industry.

AIM OF PROJECT

Detection of different parameters within the mining environment and to provide communication establishment between sensors and IoT.

OBJECTIVE OF THE PROJECT

- **Monitoring:** To monitor the parameters like fire, temperature, water level detection, and gas detection.

- **Communication**: Monitored data will be transmitted to the Internet of Things (IoT) web server.

- **Control:** To control the temperature and the fire in the mine system using the sprinkler.

LITERATURE SURVEY

Sr. No	Title Of Research Paper	Author Name	Published Year	Remark
1.	"Automatic 3D underground mine mapping"	Daniel F. Huber	14 July 2003	This paper present sour experimental set up, the automatic 3D modelling method used, and the results of the field test.
2.	"Wireless Information and Safety System for Underground Mines".	L. K. Bandyopadhyay	8 October 2011	This paper associated software has been developed for tracking of underground miners and moveable equipment by wireless sensor networking in mines.

Sr. No	Title Of Reserch Paper	Author Name	Publishd Year	Remark
4.	“Coal Mine Security System”	Warsha M. Choudhari	10 December 2012.	In this paper accident situation, provides the intelligent decision making to rescue and disperse the personnel and equipment.
5.	“GSM Based Flexible Calling System For Coal Mining Workers”	Himanshu K. Patel	April 2013	The purpose of this paper is to help people in emergency in remote location as early as possible. This system can useful in villages having no electricity. .

SYSTEM BLOCK DIAGRAM

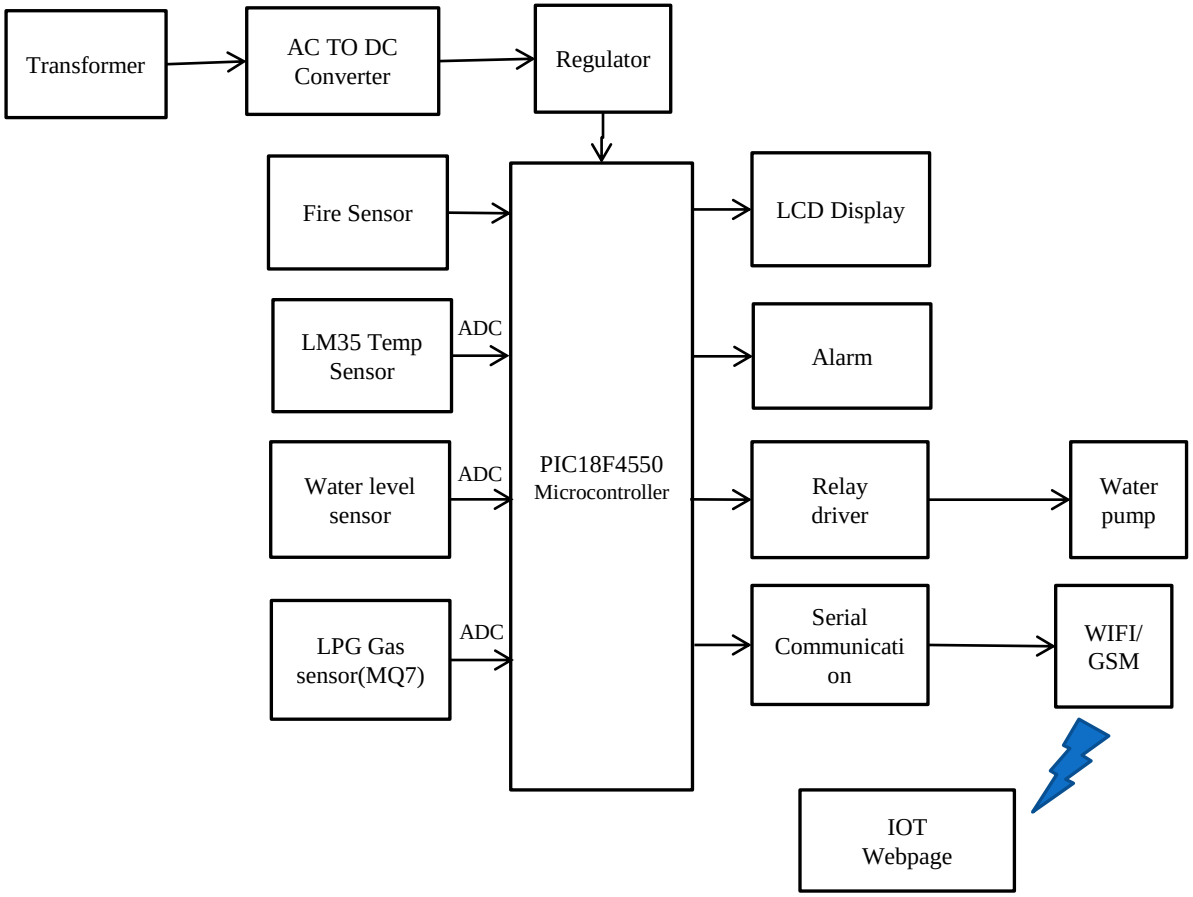

Fig 1. Block Diagram Of Mine Unit

WORKING

- The 230v AC Supply is provided. Due to the Transformer the 230V AC is Converted into 12 v AC.
- Then the AC to DC Convertor is used which Converts 12v Ac to 12V pure DC.
- Then the Regulator converts the 12V DC into a 5V supply. Then that 5V supply is given to the entire circuit.
- All the components like, sensors, microcontroller, LCD display, and Alarm Operates on a 5v supply.
- When these sensors sense the environment & if the condition or the Value of any parameter goes above the set value then the Buzzer gives the alarm.

WORKING

- If the fire increases more, then the relay driver helps to turn on the water pump.
- Meanwhile, the GSM provides the Information on the lot web page.
- The IoT webpage displays the entire monitoring process of the different sensors.
- It displays all the parameters on the webpage in the form of graphs.

HARDWARE COMPONENTS

MICROCONTROLLER (PIC184550)

Fig: PIC18f4550

It is an 8-bit enhanced flash PIC Microcontroller that comes with nano Watt technology and is based on RISC architecture.

PIC18F4550 is a PIC microcontroller, introduced Microchip, and mainly used in automation and embedded systems.

FIRE SENSOR

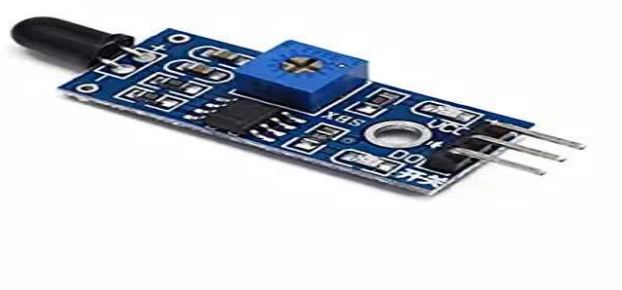

Fig: Fire Sensor

- Fire sensor is the most sensitive to ordinary light that is why its reaction is generally used for flame alarm purposes.
- Wavelength in 760 nm to 1100 nm range of light source.
- The sensor and flame should keep a certain distance to avoid high-temperature damage to the sensor.
- Operating voltage 3.3V-5V.
- IT gives digital switch outputs (0 and 1).

MQ2 GAS SENSOR

Fig: MQ2 Gas Sensor

- This MQ2 LPG gas sensor detects the concentrations of LPG gas in the air
- Operating Voltage is +5V.
- The load resistance is adjustable.
- Stable and long lifetime.
- Fast response and High sensitivity.

TEMPERATURE SENSOR (LM35)

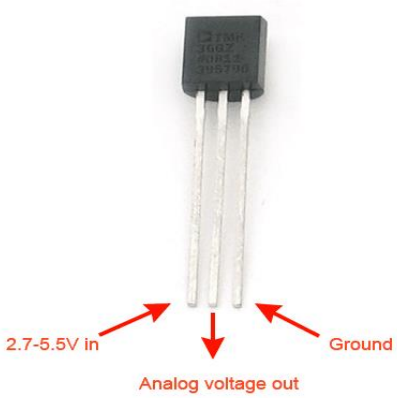

Fig: LM35 Temperature Sensor

- The LM35 series are temperature sensors.
- It has an output voltage that is proportional to the Celsius temperature.
- Operating Voltage is +5V.
- It gives analog output.
- Gives accurate centigrade calibration.

Water level sensor

Fig: Water level sensor.

- It is having a series of parallel wires exposed traces that measured droplets/water volume in order to determine the water level.
- Working Voltage: DC 3-5V.
- Detection Area: 40 mm x 16 mm.
- Fixed Hole Size: 3.2 mm.
- Size: 65 mm x 20 mm x 8 mm.

LCD DISPLAY

Fig: 16*2 LCD Display

- LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications.
- A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits.
- A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines.

SIM900A QUAD BAND GSM/GPRS SERIAL MODEM

Fig: GSM

- This GSM modem **SIM900A** enables easy connection with the computer or laptop.
- It is designed to provide wireless communication between a wide range of devices.
- Supply voltage 3.4-5V.
- Operating temperature: -40C to +85C
- One SIM card interface.

PCB LAYOUT (MINE UNIT)

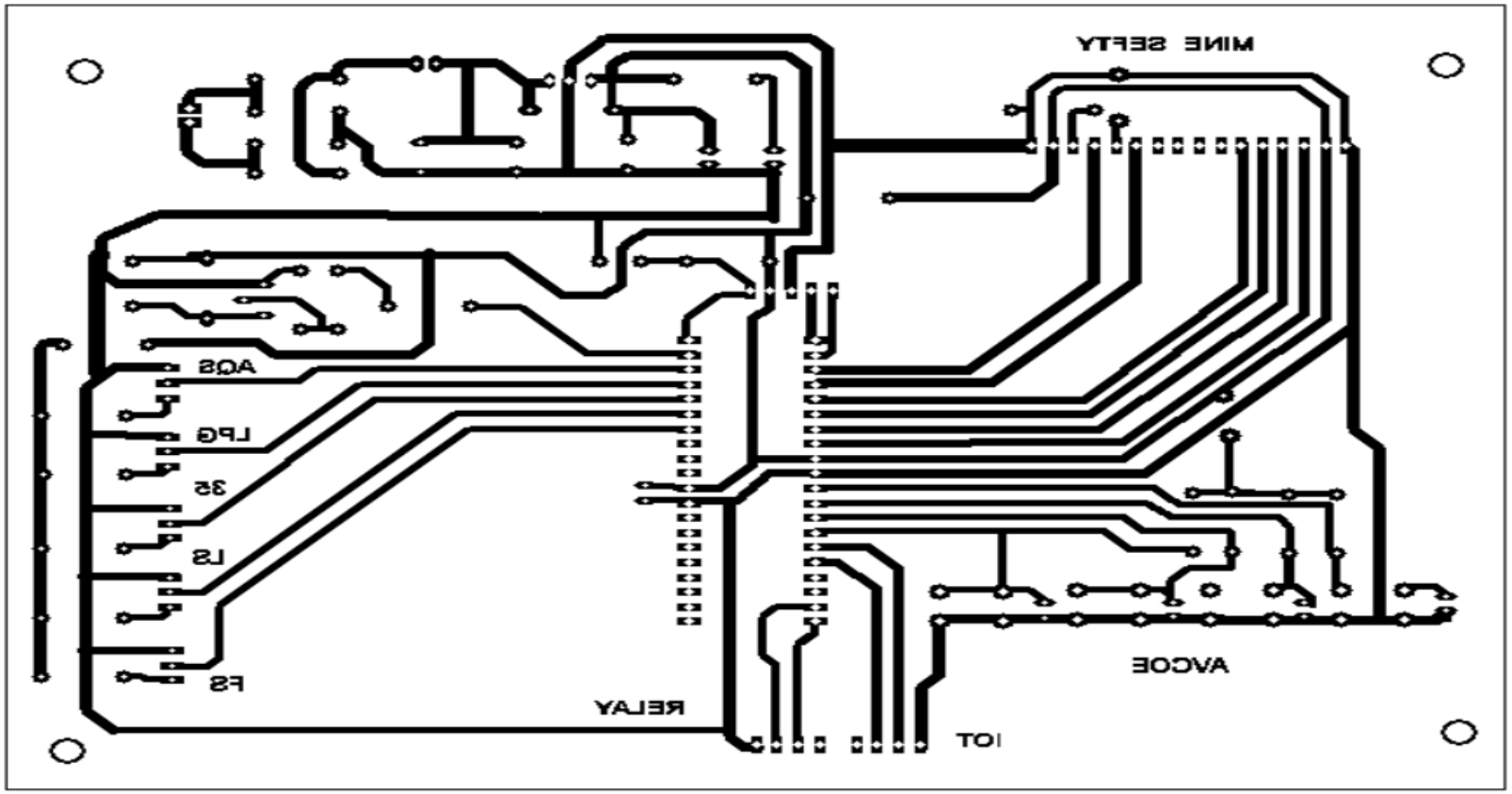

Fig.8. PCB Layout

ADVANTAGES

- Safety monitoring of the Environment.
- Improved services in the coal mine.
- Providing wireless connection security.
- Faster Checked Out / In.
- Prevent high Temperatures, Humidity, and Harmful gases.
- Quick searching and can able to give the warning.
- Cost is less.

DISADVANTAGES

While Mine Safety Systems are designed to improve safety and prevent accidents in mining operations, there can be some disadvantages to their implementation. Some of the disadvantages of mine safety systems include:

1. **Cost**: Implementing mine safety systems can be expensive

2. **Complexity**: Mine safety systems can be complex and require specialized knowledge and skills to design, install, and maintain.

3. **Dependence on technology**: Mine safety systems rely on technology such as sensors, alarms, and communication systems.

4. **Resistance to change**: Workers may be resistant to new technologies or procedures.

APPLICATION

- Use for Underground Mine System.
- It provides emergency communication and response.
- Mine safety systems are primarily used in the mining industry, some of the technologies and applications used in these systems can also be applied in other industries where there is a need for monitoring and controlling hazards and ensuring worker safety.
    - Construction.
    - Oil and Gas.
    - Transportation.
    - Manufacturing, etc.

FLOWCHART - 1

1. MINE UNIT

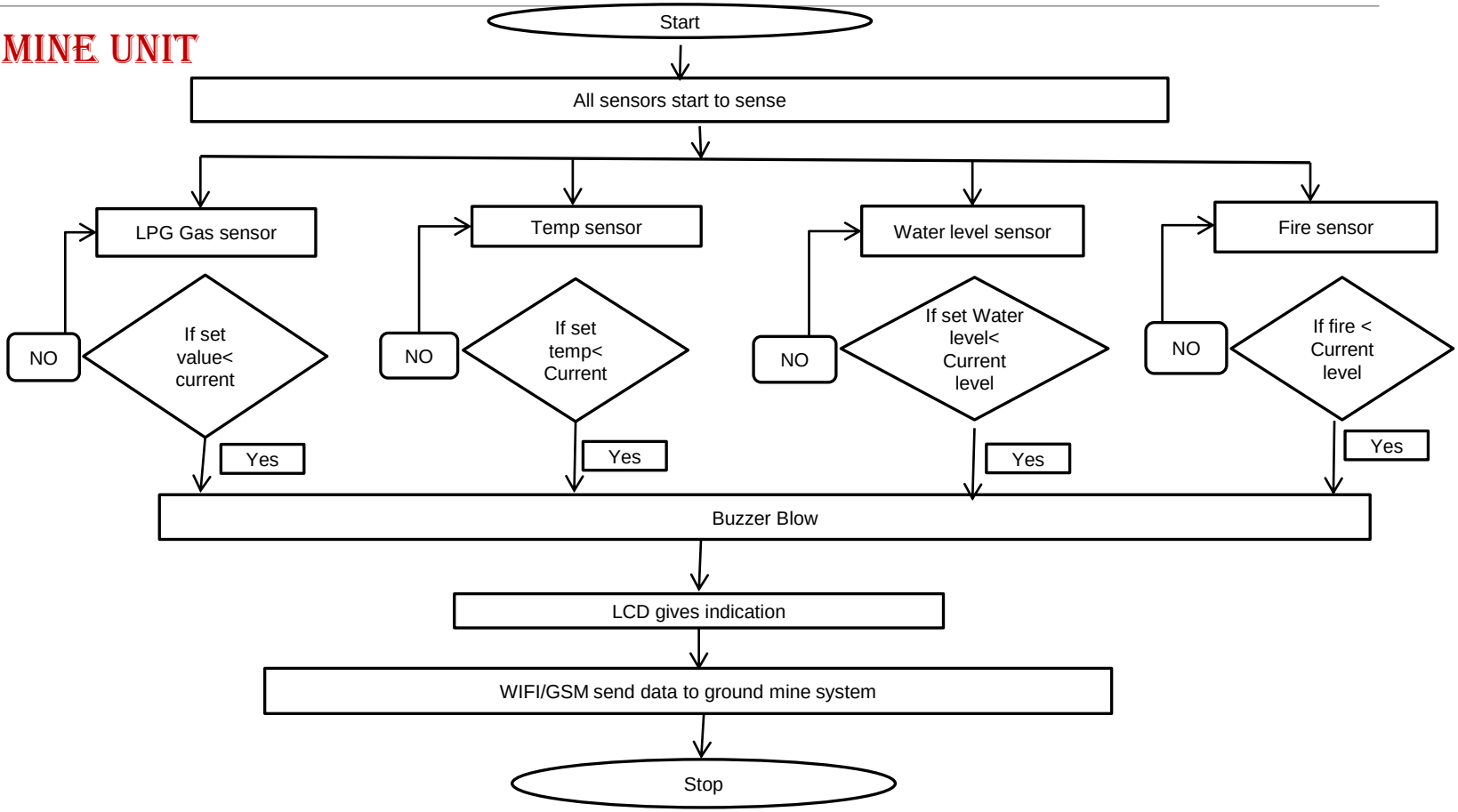

Fig: flowchart (mine unit)

FLOWCHART-2

2.BASEMENT UNIT

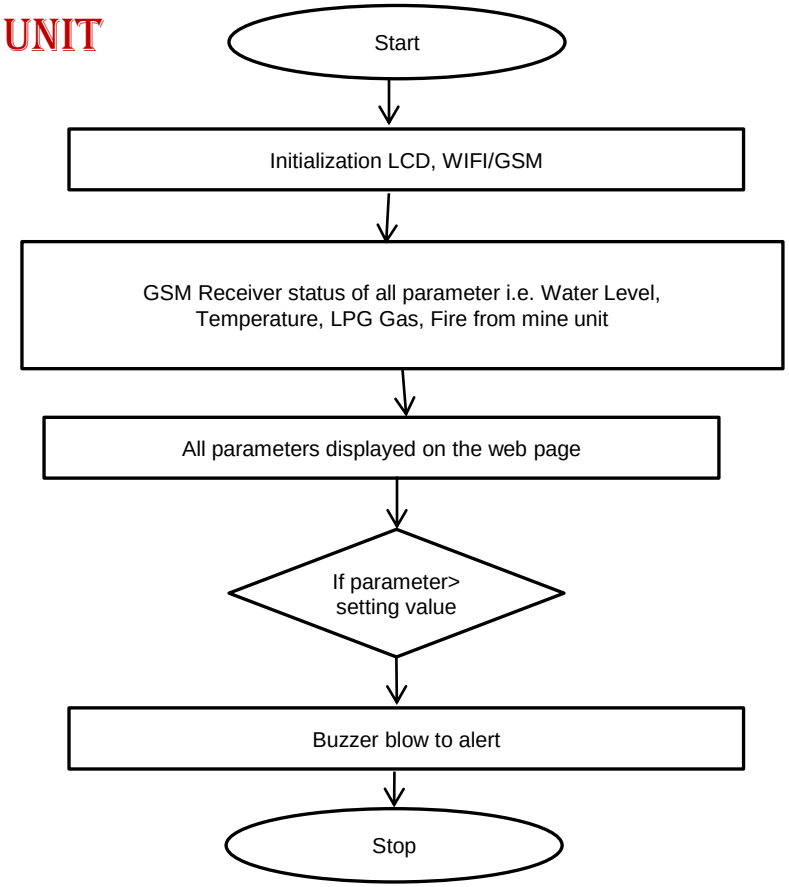

Fig 3. flowchart (Basement unit)

PROJECT EXPENDITURE

component	specification	quantity	price	cost
PIC18F4550	40pin, 3.3 v Supply	1	1650	1650
Temp sensor	LM35	1	120	120
Fire sensor	ADC out	1	180	180
Water level Sensor	ADC out		250	250
Co/Co2 Gas Sensor	MQ7		640	640
Relay board	12V DC 100MA	1	350	350
Transistor	BC547	3	4	12
Resistors	1k,10k	16	2	32
Capacitor	0.1uf,0.0.1uf	4	4	16
Diode	1N4007	6	3	18
Power supply board	5V /3.3V	2	350	700
WIFI or GSM Module	12V DC 2Amp	1	1250	1250
PCB	GLASS EPOXY	2	140	300
BUZZER	5V DC	2	35	70

CONCLUSIONS

- IT is the study of real-time monitoring of toxic gas and other parameters present in underground mines that have been analyzed using wireless sensors.
- It has developed a real-time monitoring system to provide a clearer and more point-to-point perspective of the underground mine system and also provide reliable communication using IOT between mine workers.
- This system is displaying the parameters on the LCD at the underground section where the sensor unit is installed as well as on the monitoring unit.

FUTURE SCOPE

- Using additional sensors all possible safety issues could be monitored such as gases, dust, vibrations, fire, etc.
- The Other important data can be communicated through this system making it convenient where wired communication is a hindrance.
- The control can be governed from the surface itself as the system provides easy access.

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[6] "Wireless Sensor Network-based Monitoring System for Coal Mine Safety" by Kunal Maurya, et al. This paper presents a wireless sensor network-based monitoring system for coal mine safety that uses various sensors to monitor gas concentration, temperature, humidity, and other environmental parameters.

[7] "Wireless Sensor Network-based Coal Mine Safety Monitoring System" by Jianguo Wang, et al.

THANK YOU