An IoT Based Coal Mine Safety And Monitoring System Using Lorawan

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Abstract:

Today protection of miners is a main challenge. Miner's health and lifestyles is susceptible to several critical issues, which consists of no longer only the working environment, however also the after effect of it. Mining activities release unsafe and poisonous gases in turn exposing the associated people into the chance of survival. This puts a lot of stress on the mining industry. To increase the productivity and decrease the price of mining along with consideration of the security of workers, an innovative strategy is required. Miners health is in danger on the whole because of the toxic gases which are very regularly launched in underground mines. These gases cannot be detected without problems through human senses. This thesis investigates the presence of poisonous gases in quintessential areas and their effects on miners. A real time monitoring gadget using wireless sensor network, which consists of multiple sensors, is developed. This gadget monitors surrounding environmental parameters such as temperature, humidity and a couple of toxic gases.This gadget additionally offers an early warning, which will be helpful to all miners current inner the mine to store their existence before any casualty occurs. The system makes use of Lorawan science to establish wi-fi sensor network. It is wireless networking preferred IEEE 802.15.4, which is suitable for operation in harsh environment.

I INTRODUCTION:

Underground mining operations proves to be a risky assignment as some distance as the safety and fitness of workers are concerned. These dangers are due to distinctive methods used for extracting different minerals. The deeper the mine, the larger is the risk. These security problems are of grave concern especially in case of coal industries. Thus, protection of people need to always be of major consideration in any structure of mining, whether or not it is coal or any other minerals. Underground coal mining includes a greater hazard than open pit mining due to the troubles of ventilation and viable for collapse. However, the utilization of heavy equipment and the methods carried out throughout excavations end result into safety risks in all kinds of mining.

Modern mines frequently enforce a number of protection procedures, schooling and training for workers, health and protection standards, which lead to full-size modifications and upgrades and safety level both in opencast and underground mining. Coal has constantly been the most important resource of electricity

in India, which has significantly contributed to the rapid industrial development of the country. About 70% of the power generation is dependent on it thus, the importance of coal in power quarter is indispensable. But the

manufacturing brings with it the different by products, which proves to be a achievable danger to the environment and the humans associated with it. In lieu of that the present work is a sincere attempt in analyzing the graveness and designing a real time monitoring machine of detection by the use of the Lorawan technology.

II   EQUIPMENTS:
A. HARD WARE:
i.   RASPBERRY PI PICO:

If you are into IoT, robotics, or automation, then there are appropriate possibilities that you ought to have heard about the latest revelation from the Raspberry Pi foundation, i.e. the Pi Pico. If not, then allow me to introduce you the microcontroller board, YES, you examine it right, A Microcontroller!!! Pi Pico is the first microcontroller from the producers of Raspberry Pi, based on the Raspberry Pi's RP2040 microcontroller chip and working on ARM's Dual-core cortex M0+ architecture. It works at frequencies up to 133MHz and albeit looking powerless when compared to the other contributors of the Pi family it has a lot to offer. Unlike the other Pi boards which are essentially a Linux based totally single board computer, Pico is a finances friendly microcontroller with 264kB multi-bank high-performance SRAM, sixteen kb of on-chip cache, and 2MB of flash storage.

It is clearly an excellent board considering how inexpensive this board is, priced at just USD 4 (around INR 300 in Indian market) it is competing at once against the likes of hooked up Arduino boards, blowing them out of water in phrases of energy and velocity when competed towards the in a similar fashion priced modules.

ii.   Carbon Monoxide Sensor (MQ7):

Various sorts of sensors are handy in the market in which semiconductor sensors are considered to have fast response. MQ7 semiconductor sensor is broadly speaking used for detecting carbon monoxide (CO). MQ-7 fuel sensor composed of micro Al2O3 ceramic tube and Tin Dioxide (SnO2). Electrode and heater are fixed into a crust.

The heater offers required work prerequisites for the work of sensitive components. The conductivity of sensor is greater along with the gasoline attention rising. When the sensor, heated with the aid of 5V it reaches at high temperature, it cleans the different gases adsorbed below low temperature. The MQ-7 have 6 pins in which 4 of them are used to fetch alerts and other two are used for supplying heating current. MQ-7 sensor consist of 2 parts. One is heating circuit and the other one is the signal output circuit. In which heating circuit is used for time manage and sign output circuit is accurately respond modifications of surface resistance of the sensor.

iii. Methane Gas Sensor (MQ-4):

MQ-4 gas sensor composed of ceramic tube and Tin Dioxide. Electrode and heater are constant into a layer. The heater gives required work stipulations for the work of touchy components. When the target combustible gas present, the conductivity of sensor is greater alongside with the gas attention rising. The MQ-4 sensor has 6 pins in which four of them are

used to fetch signals and other two are used for offering heating current.
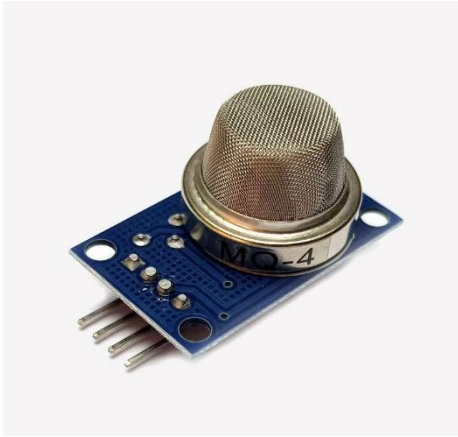
iv.   Carbon Dioxide Sensor (MG811):

This CO2 sensor is designed by way of DFRobot engineer. The MG-811 sensor is fairly sensitive to CO2 and much less touchy to alcohol and CO. The MG-

811 sensor has low humidity and temperature dependency. Its shape same as MQ-7 however parts fabric are different.

This sensor composed with the aid of strong electrolyte layer, Heater, Platinum Lead, Gold electrodes, Porcelain Tube, 100m double-layer steeliness net, Nickel and copper plated ring.

v.   DHT-11 Sensor:

This DHT11 Sensor measures the temperature and humidity. The sensor has higher reliability and very desirable stability. A resistive-type humidity measuring factor with negative temperature coefficient is used. It connects to a microcontroller and shows high-

quality quality, anti-interference and quick response ability.

B. SOFTWARE EQUIPMENTS:

a) Raspbian OS:

Raspbian is a Debian-based pc working gadget for Raspberry Pi. There are quite a few variations of Raspbian which
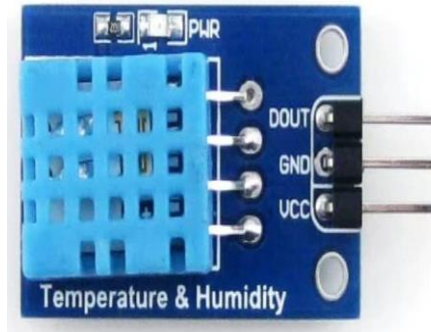
includes Raspbian Stretch and Raspbian Jessie. It has been formally provided by way of the Raspberry Pi Foundation as the foremost operating machine for the family of Raspberry Pi single-boardcomputers. Raspbian was once created by using Mike Thompson and Peter Green as an impartial project. Raspbian is exceedingly optimized for the Raspberry Pi line's low-performance ARM CPUs. Raspbian makes use of PIXEL, Pi Improved X home windows Environment, Lightweight as its essential computing device surroundings as of the state-of-the-art update. The scripts and documents created are run on the Raspbian OS.

b) MICRO PYTHON :

Python is a exceptional and effective programming language that's convenient to use (easy to examine and write) and with Raspberry Pi lets you join your challenge to the actual world. Python syntax is very clean, with an emphasis on readability and makes use of Standard English keywords. The best introduction to Python is thru IDLE, a Python improvement environment. Open IDLE from the Desktop or purposes menu. IDLE offers you a REPL (ReadEvaluate-Print-Loop) which is a instant you can enter Python instructions in to. As it is a REPL you even get the output of instructions printed to the display screen besides the usage of "print". Two variations of Python

are available: Python two and Python three Python three is the latest model and is recommended, however Python two is on hand for legacy functions which do not help Python 3 yet. IDLE additionally has syntax highlighting built in and some aid for auto completion.

III WORKING:
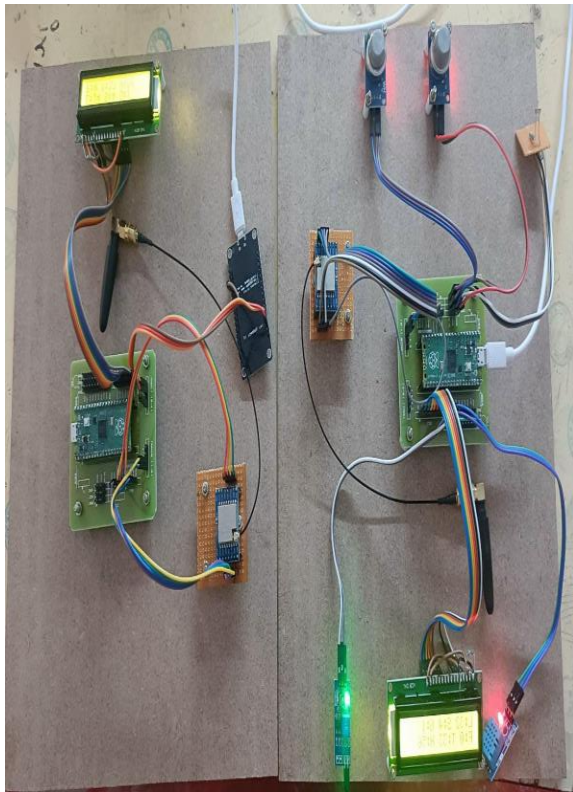
The below figure shows the transmitter section of the project, which contains a parameters and raspberry pi pico board and a LCD display, which gives the sensor values. LORAWAN module is used for the best signals in the under ground mining system. This system is helpful for the mining workers.
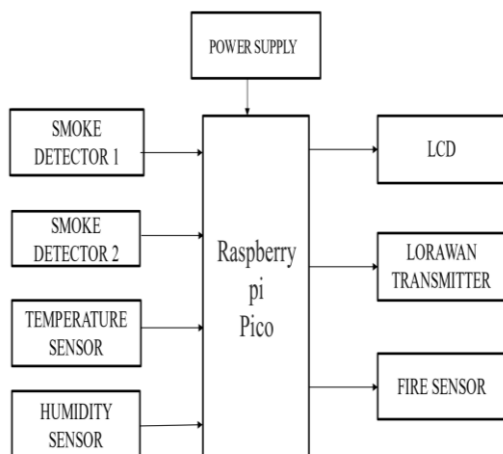
This is a receiver section of the project,which contains the raspberry pi pico board, LCD display, lora receiver module and a wifi module. As our project is IoT based, the sensed values can also dissplayed in the thing view cloud. Which we can monitor the system from anywhere.

IV CONCLUSION:
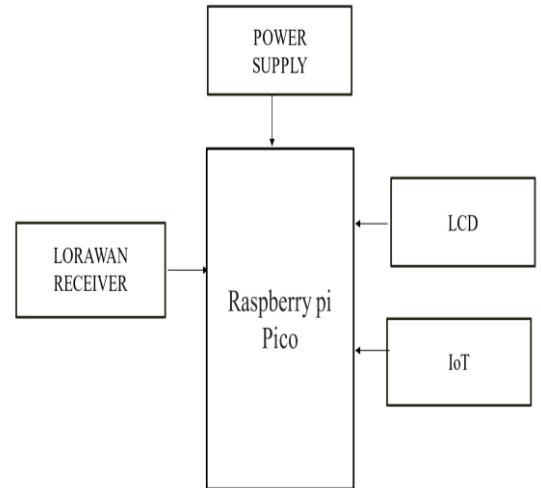
The conclusion of this project is to monitor the toxic gases that are releasing in the under ground mining.We provide a group of sensors to detect those gases and give an detection message through the LCD display.As our project is IoT based the values are stored in the system unit also.

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