FORM 1
THE PATENTS ACT, 1970
(39 of 1970)
&
THE PATENTS RULES, 2003
APPLICATION FOR GRANT OF PATENT
[See sections 7,54 & 135 and rule 20(1)]

(FOR OFFICE USE ONLY)

Application No.: .....
Filing Date: .....
Amount of Fee Paid: .....
CBR No.: .....
Signature: .....

1. APPLICANT(S):

Sr.No.	Name	Nationality	Address	Country	State
1	University of Engineering and Management Kolkata	India	University Area, Plot, Street Number 03, Action Area III, B/5, Newtown, Kolkata, West Bengal 700160	India	West Bengal

2. INVENTOR(S):

Sr.No.	Name	Nationality	Address	Country	State
1	Abhinav	India	University Area, Plot, Street Number 03, Action Area III, B/5, Newtown, Kolkata, West Bengal 700160	India	West Bengal
2	Anirban Das	India	University Area, Plot, Street Number 03, Action Area III, B/5, Newtown, Kolkata, West Bengal 700160	India	West Bengal

3. TITLE OF THE INVENTION: Nodal Wireless Communication System for Monitoring Environmental Data Fluctuations in Underground Mines

4. ADDRESS FOR CORRESPONDENCE OF APPLICANT / AUTHORISED PATENT AGENT IN INDIA:
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5. PRIORITY PARTICULARS OF THE APPLICATION(S) FILED IN CONVENTION COUNTRY:

Sr.No.	Country	Application Number	Filing Date	Name of the Applicant	Tilte of the Invention

6. PARTICULARS FOR FILING PATENT COOPERATION TREATY (PCT) NATIONAL PHASE APPLICATION:

International Application Number	International Filing Date as Allotted by the Receiving Office
PCT//	

7. PARTICULARS FOR FILING DIVISIONAL APPLICATION

Original (first) Application Number	Date of Filing of Original (first) Application

8. PARTICULARS FOR FILING PATENT OF ADDITION:

Main Application / Patent Number:	Date of Filing of Main Application

9. DECLARATIONS:

(i) Declaration by the inventor(s)

I/We ,Abhinav,Anirban Das, is/are the true & first inventor(s) for this invention and declare that the applicant(s) herein is/are my/our assignee or legal representative.

(a) Date: 21.12.2020

(b) Signature(s) of the inventor(s): A./.AD

(c) Name(s): Abhinav,Anirban Das

(ii) Declaration by the applicant(s) in the convention country

I/We, the applicant(s) in the convention country declare that the applicant(s) herein is/are my/our assignee or legal representative.

(a) Date: -----

(b) Signature(s) : .....

(c) Name(s) of the singnatory: University of Engineering and Management Kolkata

(iii) Declaration by the applicant(s)

- **The Complete specification relationg to the invention is filed with this application.**
- **I am/We are, in the possession of the above mentioned invention.**
- **There is no lawful ground of objection to the grant of the Patent to me/us.**
- **I am/We are, the assignee or legal representative to true first inventors.**

10. FOLLOWING ARE THE ATTACHMENTS WITH THE APPLICATION:

Sr.	Document Description	FileName
1	COMPLETE SPECIFICATION	Complete Specifcation.pdf
2	DRAWINGS	Drawings.pdf

I/We hereby declare that to the best of my/our knowledge, information and belief the fact and matters stated hering are correct and I/We request that a patent may be granted to me/us for the said invention.

Dated this(Final Payment Date): 21·12·2020

Signature: .....

Name: Satyajit Chakrabarti

To The Controller of Patents

The Patent office at KOLKATA

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FORM 18

THE PATENT ACT, 1970
(39 of 1970)
&
THE PATENTS RULES, 2003

REQUEST/EXPRESS REQUEST FOR EXAMINATION OF APPLICATION FOR PATENT

[See section 11B and rules 20(4) (ii),24B (1) (i)]

1. APPLICANT(S)/OTHER INTERESTED PERSON(S):

(a) Name :1. University of Engineering and Management Kolkata
(b) Nationality :1 .India
(c) Address :1 .University Area, Plot, Street Number 03, Action Area III, B/5, Newtown, Kolkata, West Bengal 700160
(d) Date Of Publication Under Section 11A :29/07/2022 00:00:00

2. STATEMENT IN CASE OF REQUEST FOR EXAMINATION MADE BY THE APPLICANT(S)

I/We University of Engineering and Management Kolkata hereby request that my/our application for patent invention number 202131003593 filed on 27 Jan 2021 for the titled NODAL WIRELESS COMMUNICATION SYSTEM FOR MONITORING ENVIRONMENTAL DATA FLUCTUATIONS IN UNDERGROUND MINES shall be examined under section 12 and 13 of the Act.

4. ADDRESS FOR SERVICE

University Area, Plot, Street Number 03, Action Area III, B/5, Newtown, Kolkata, West Bengal 700160

Dated this(Final Payment Date):09/08/2022
Signature
Name of the Signatory
A. Chatterjee

To,
The Controller of Patents,
The Patent Office
At Kolkata

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Title: Nodal Wireless Communication System for Monitoring Environmental Data Fluctuations in Underground Mines

Inventors:

Abhinav, CSE, UEM Kolkata, abhinav33303@gmail.com

Anirban Das, CSE, UEM Kolkata, anirban-das@live.com

ABSTRACT

This system aims to establish a wireless network system inside the underground mines which will monitor its environment. It will help in getting proper information of many environment values like temperature, pressure , level of different gases etc . At time of any emergency these values will directly indicate the seriousness of the situation and help in reducing the life risk in mining sector .There will a series of devices(nodes) inside every part of mine which will communicate to its adjacent devices(or nodes) to transfer information and this way finally every system(or nodes) is connected to base node and base node will have all the important values from each and every part of mine and from there operator can decide if any place is under emergency or every this is alright inside mines or we can let the device to do decide that there is an emergency or not . This device is also capable of controlling mining machines and tools but it is the field of future study.

FIELD OF THE INVENTION

- Here the field of invention is a wireless networking system inside a mine which will monitor the mine environment values (like temperature , pressure and level of different gases etc.) at several areas inside the mines and send these data to base.
- Here transceivers (nrf24L01) are used to connect each device(or nodes) to its adjacent devices(or nodes) or at some points there can be two or more devices (nodes) connected to one device (node).
- Whole networking is based on tree topology.
- Each and every system (or nodes) can be placed in between 800 meters(distance may vary for different places) for fully functional transmission of data.

BACKGROUND OF THE INVENTION

- Normally there is only one traditional telephone is available in only few places inside underground mines and this phones are mainly used for loading and unloading of minerals(for example coal) from the mines .

- Presently only wired systems are used for communication which gets damaged at time of emergency.
- Here we are using radio frequency technology (2.4 GHz) for communication which will reduce the use of wires.
- each system consist of a micro controller ATmega328P-PU with arduino bootloader , one RF Transceiver with frequency 2.4 GHz (nrf24L01) , one barometric sensor(BMP180) and one methane sensor (MQ4). And only base system(node) is consist of a screen (OLED display)for monitoring.
- This system operates on very less current so it can be used with lithium polymer batteries and life will be of several months depending on battery size.
- This system sends real time values of temprature , pressure and methane sensor.
- Many more sensors can be connected to this system for more safety.and even machines can be operated by this systems.

SUMMARY OF THE INVENTION

This system is the replacement of the traditional telephones used in the mines. Which works on wiring and its main use is related to loading and unloading of minerals which are extracted from the mines. It requires a huge electric power for operation and it in not an efficient for communication in any emergency , so our aim is to design a new system namely mine environment information system which works on wireless technology with a battery backup so that it can remain functional in case of any power failure .This mine environment information system is based on tree topology where every device is connected to other devices by RF technology using nrfl01 modules and a micro controller ATmega328P-PU. This nrf24l01 is a transceiver which can send as well as receive data .It works on 2.4GHz frequency which is the freely available band so no extra permission is needed .This board features a reverse polarized SMA connector for maximum RF range. And there are PA and LNA circuit on board for signal amplification, with the external antenna it can reach long distance than the one without these parts. This module comes with the 2.4G antenna (2DB), with 250Kbps standard transmission rate on open air it can communication to0.8 to 1 kilometers .Its Maximum output power is +20dBm . Its Emission mode current(peak) is 115mA , Receive Mode Current(peak) value is 45mA , Sensitivity 2Mbps mode in received is -92dBm , Sensitivity 250kbps mode in received is -104dB , Its LNA Noise is 2.6Db , Antennapeak value is 2Db and its interface type with micro controllers is SERIAL PERIFERAL INTERFACE (SPI) which makes it very fast and its wireless transmission features makes it best for our use ,inside mines . Here each system (or node) sends its sensor data to the next node and it combines its data with the previous nodes data and send this to next node this way all data reach to the base system (or node) and all the information is displayed on the system. Here we are using BMP 180

barometric sensors. BMP180 is one of sensor of BMP series. Barometric Pressure or Atmospheric pressure are measured by these sensors. BMP180 is a high precision sensor designed for consumer applications. Barometric Pressure is nothing but weight of air applied on everything. The air has weight and wherever there is air its pressure is felt. BMP180 sensor senses that pressure and provides that information in digital output. Also the temperature affects the pressure and so we need temperature compensated pressure reading. To compensate, additionally it also have a very good temperature sensor. It can measure temperature and altitude precisely. Its Pressure range is about 300 to 1100hPa. It have a High relative accuracy of ±0.12hPa and its power consumption is 3uA which is very low . its Pressure conversion time is 5msec . These all features make it best for its use inside mines. and we will also use MQ4 gas sensor for measuring methane levels inside the mines . MQ4 is a gas sensor which is highly sensitive to methane and natural gas . it gives fast response and have very long live it can measure the concentration of ch4 from 200ppm to 10000ppm. Its operating temperature is from -10°C to 60°C .its operating voltage around 5 volts . this sensors should go in pre heating mode for around 20 seconds and then it can be used here for all branch node and leaf node devices we are using ATMEGA328 microcontroller with Arduino bootloader which is very easy to use and we connected BMP180 , NRF24L01 and MQ4 to the microcontroller . For the base node we connected a OLED display and one NRF24L01 module to ATMEGA328 microcontroller .This system provides the real time information about the temperature, pressure and methane levels present at different parts of mine and based on that information of any emergency can be easily evaluated. This system will reduce the life risk in the mining sector. Additionally we can connect many numbers of sensors to this device and even control mining tools and machines with this devices for example exhaust fan speed can be controlled by the temperature data collected by this device.

BRIEF DESCRIPTION OF THE DRAWINGS:

Fig 1: It is the block diagram representation of installation and working of these systems.

Fig 2: It is the circuit diagram of all the system inside the mines.

Fig 3: It is the circuit diagram of the system used on base .

Fig 4: It is the real image of the developed prototype ,with few of the patented features.

CLAIMS

We claim the concept of mines environment monitoring by using tree networking system inside the mines using NRF24L01 transceivers and the design of the monitoring system. And I want to claim whole output of the system.

PATENT CITATIONS

Cited patent	Filling date	Publication date	Applicant	Title
CN201410566989.2A	2014-10-22	2016-07-06	唐湛 (Tángzhàn)	Heart rate identifying equipment and underground coal mine blasting staff identifying method based on the equipment
CN201610385487.9A	2016-06-03	2016-08-17	谢宁俊 (Xièníngjùn)	Person heart-rate monitoring method, system and device based on relaying transmission

FIG : 1

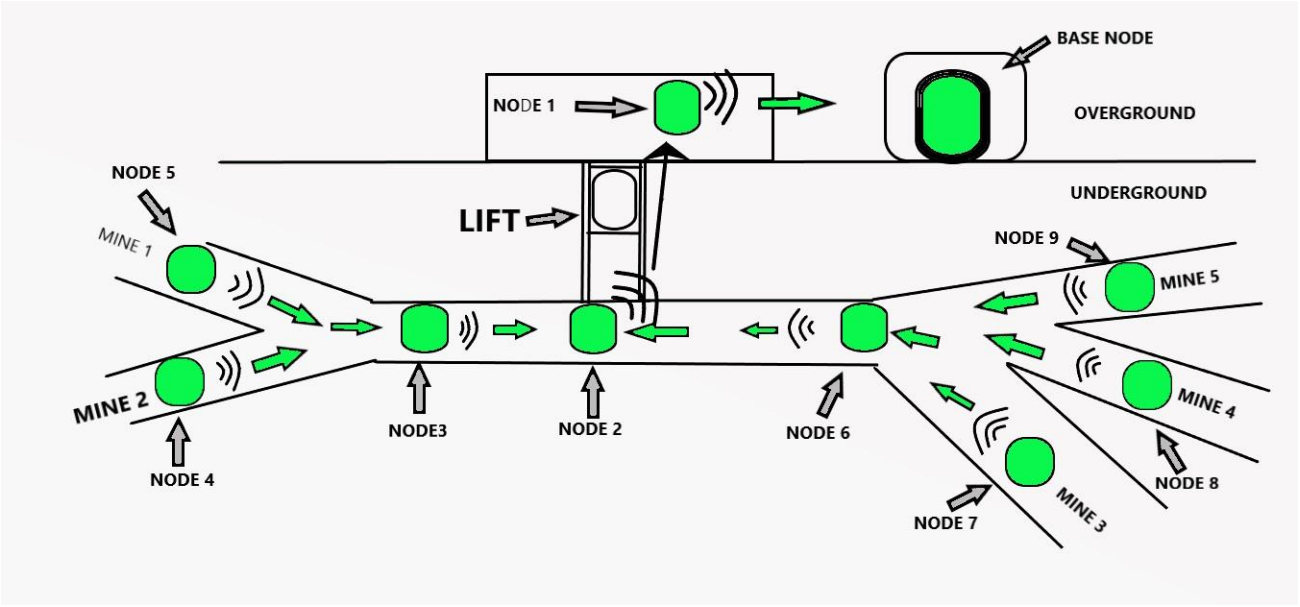
BASE NODE
NODE 1
OVERGROUND
UNDERGROUND
NODE 5
LIFT
MINE 1
NODE 9
MINE 5
MINE 2
MINE 4
NODE3
NODE 2
NODE 6
NODE 8
NODE 4
NODE 7
MINE 3

FIG : 2

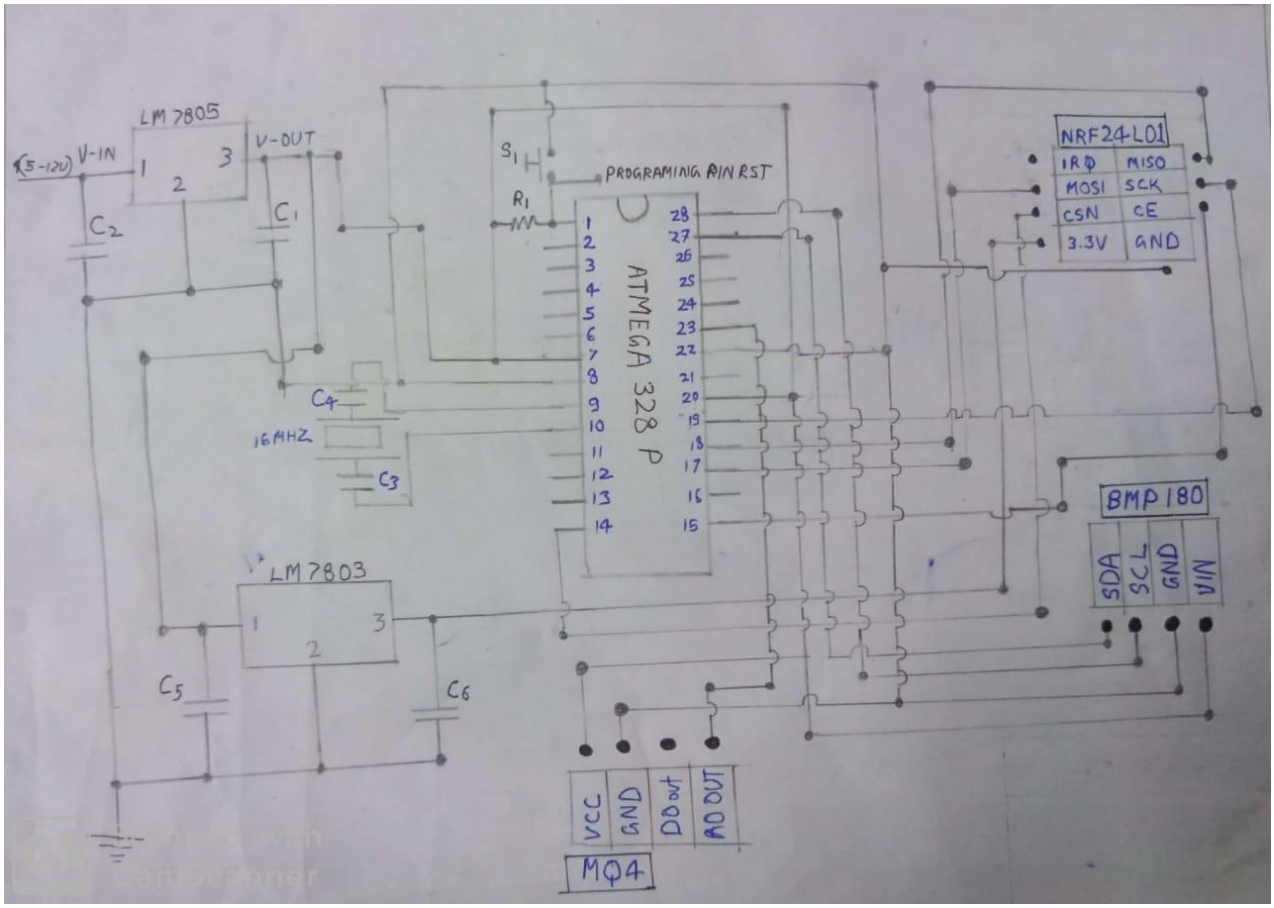
LM 7805
(5-12V)
V-IN
V-OUT
1
2
3
C2
C1
S1
PROGRAMING PIN RST
R1
ATMEGA 328 P
1 2 3 4 5 6 7 8 9 10 11 12 13 14
28 27 26 25 24 23 22 21 20 19 18 17 16 15
C4
16MHZ
C3
LM 7803
C5
C6
NRF24L01
IRQ MISO
MOSI SCK
CSN CE
3.3V GND
BMP180
SDA SCL GND VIN
VCC GND DO out AO OUT
MQ4

FIG :3

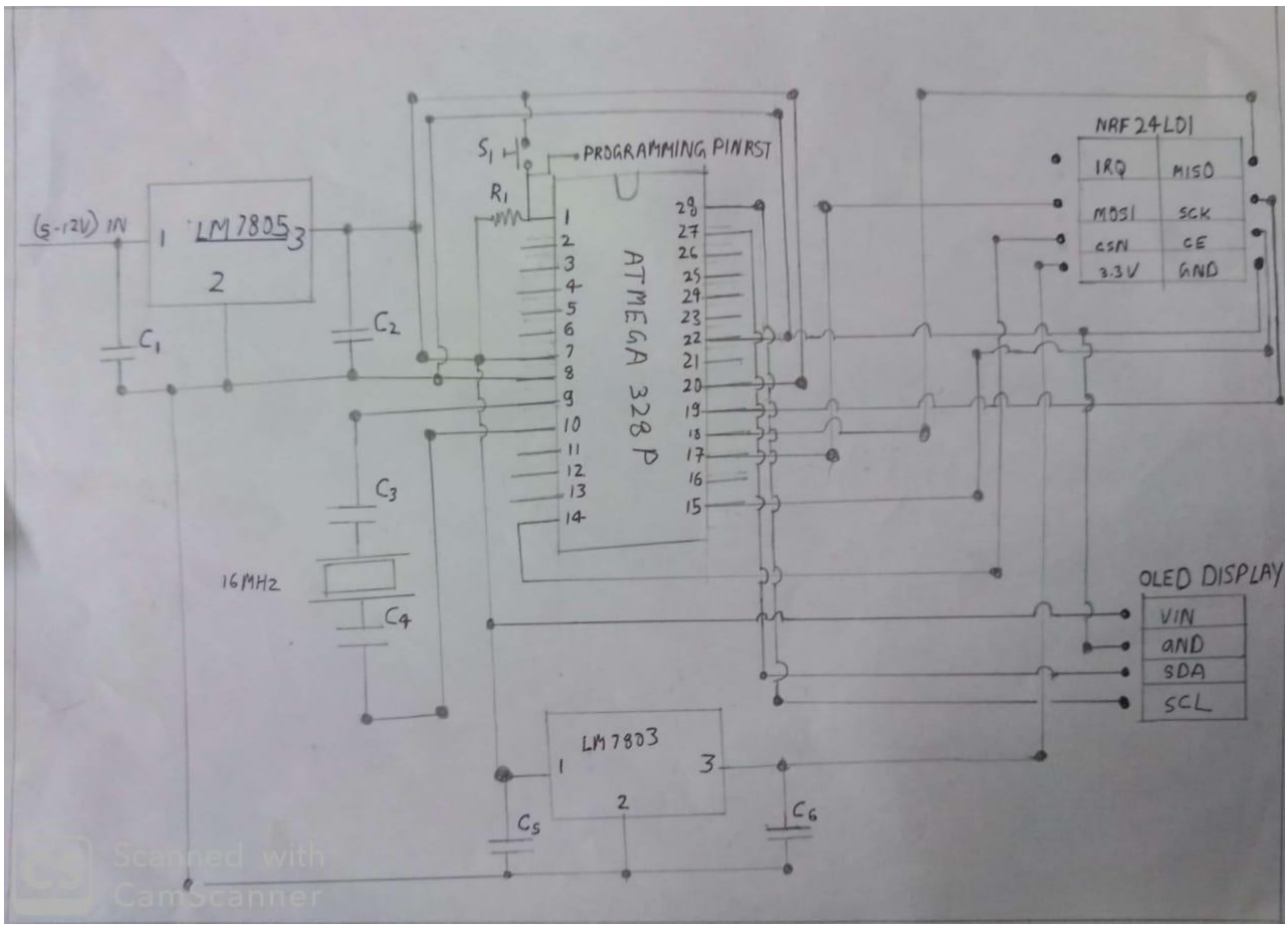
(5-12V) IN
LM7805
1
2
3
C1
C2
C3
C4
16MHz
S1
PROGRAMMING PIN RST
R1
ATMEGA 328P
1
2
3
4
5
6
7
8
9
10
11
12
13
14
29
27
26
25
24
23
22
21
20
19
18
17
16
15
NRF 24L01
IRQ
MISO
MOSI
SCK
CSN
CE
3.3V
GND
OLED DISPLAY
VIN
GND
SDA
SCL
LM7803
1
2
3
C5
C6
Scanned with CamScanner

FIG : 4