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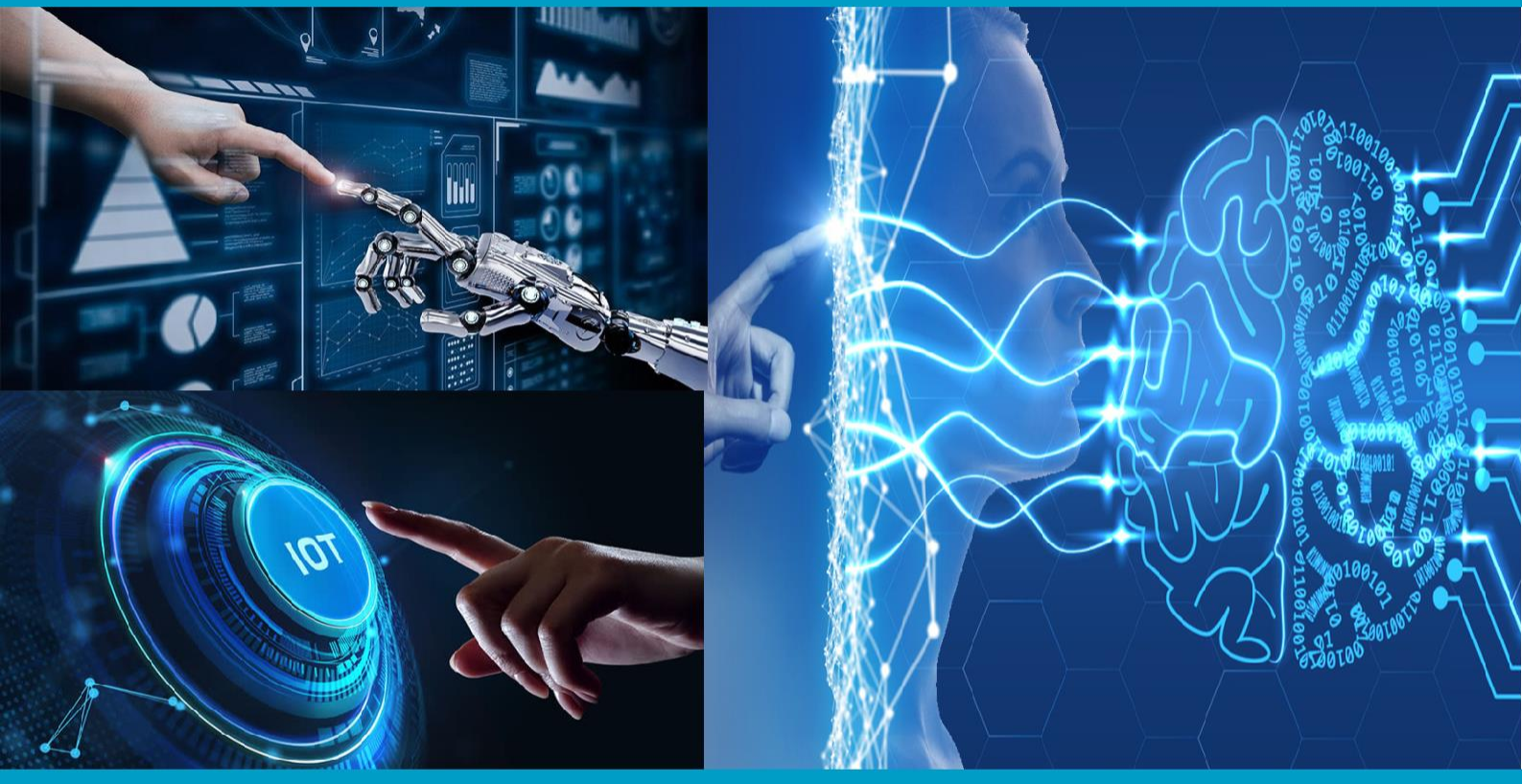


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# Development of Earthing System Health Monitoring and Alert System

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**ABSTRACT**: Grounding is a protection method that uses a grounding electrode placed in the ground to pass leakage current from an electrical system to the earth. Rod electrodes, plate electrodes, mesh-connected electrodes, and other types of grounding electrodes can be used. To safeguard the safety of working employees and costly installed equipment in the substation, a low resistance path for the discharge of short circuit fault current is required. As we know the industries consisting of inductive loads especially high wattage machine and all the machines are connected to the earthing system. It is very important to monitor the earthing system. Mostly earthing are pipe type earthing and plate type earthing so, in a substation or any installation the pipe earthing are mostly used. If the leakage current increases and the person get in contact with the machine, it may get a severe shock. Hence, it is very important to continue monitoring the earthing system. This project deals with the continuous monitoring of the earthing system. In this project we continuously monitoring the leakage current on the LCD, if the leakage current is more than permissible limit then there will an alarm and similarly if the moisture of the earth gets decreases, the earth resistance increases. This will be also displayed on the LCD that will especially monitor for the leakage current magnitude in order to maintain in the permissible limit. If the permissible Limits get increases there will be an alarm signal or there will be a message to the observer through IOT interfacing device. We are mostly using this technology to transfer the data from one place to another so, overall our project deals with the remote monitoring of the earthing system.

**KEYWORDS**: Pipe Earthing, Microcontroller Pic16f886, Leakage Current, Earth Resistance, Moisture Level.

## I. INTRODUCTION

The Earthing was probably discovered by the German scientist Carl August Steinheil in the year of 1836–1837, that the ground could be used as the return path to complete the circuit, making the return wire unnecessary.Earthing, also known as grounding, refers to the process of connecting electrical equipment and installations to the Earth's conductive surface. It involves establishing a direct connection between the electrical system and the ground, creating a safe pathway for excess electrical energy to dissipate harmlessly. Earthing serves several important purposes in electrical systems like Earthing minimizes the risk of electric shocks by diverting fault currents away from people and objects , It helps prevent damage to electrical equipment and appliances by providing a low-resistance path for fault currents , Proper earthing reduces the risk of lightning strikes by providing a path for lightning currents to safely dissipate into the ground, Earthing helps mitigate electromagnetic interference, ensuring the proper functioning of sensitive electronic devices. There are various types of earthing systems used in different situations. Leakage current is the natural phenomenon in electrical circuits of current flow from the circuit's live electrical components to the frame of the device or to ground. This is due to the intrinsic physics law that energy flows from higher to lower potential; when a conductor has a potential difference with respect to the earth (in other words, a voltage above 0 V), some current will flow from the conductor to the earth. Leakage current typically flows through the earth connection but may also flow through live or neutral wires.

Earthing plays a very important role in the electric power system. Earthing is a process of transferring the immediate discharge of electrical energy directly to the earth with the help of low resistance wire. Resistance to an earth connection varies due to the structure of the earth, chemical content, moisture, temperature, the season of the year, depth and diameter of the rod, and other reasons. This is done by connecting the non-current carrying part of the equipment to the neutral part of the supply system with the ground. Earthing must have the least resistance so that the leakage current has the least resistance path to flow current. Resistivity increases when soil moisture decreases. The person coming into contact with the machine can even cause a fatal accident. If there is moisture in the soil, the leakage current is properly grounded and the resistivity decreases.

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## II. OBJECTIVES

1. To measure the earthing resistance of earthing pit.
2. System should measure moisture of soil.
3. System should have a small display for showing values.(resistance, leakage current, moisture of soil ).
4. System should be able to give alert in case value is above permissible resistance. (Buzzer and red light)

## III. PROJECT METHODOLOGY

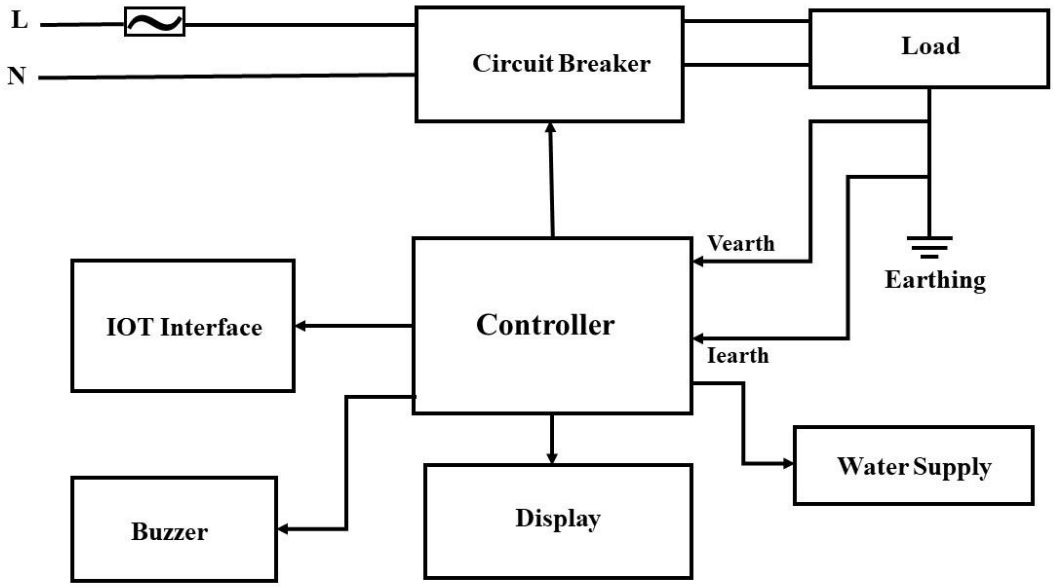


**Fig. 3.1 Block Diagram of Development of an Earthing System Health Monitoring and Alert System**

Block diagram for Development of an Earthing System Health Monitoring and Alert System is shown in above figure 3.1. The block diagram consist of seven main blocks such as controller , Display ,Water supply , Buzzer ,Circuit Breaker , Load etc . It is actually based on variation of resistance with respect to leakage current. The System is design for decreasing the resistivity and increases the moisture level of the soil and easily distribute the leakage current. Now in industries have using typical method, manually start and stop the water supply of earthing or it construction nearer to water reservoir locations like river, lake, artificial water tank etc. it also away from main station near (25km). In some industries does not have any kind of provision of water reservoir system near to their plants. i.e. they are using continues water supply arrangement for earthing. Design and develop an automated Earthing System Health Monitoring and Alert System to continuously monitor the earthing system's healthiness, detect potential malfunctions or anomalies in real-time, and alert electrical staff promptly to prevent electrical hazards, equipment damage, and ensure electrical infrastructure reliability.

## IV. WORKING OPERATION

Analog to digital converter input for voltage and current measurement
Serial communication interface for debugging
Digital input/ output ports for relays & sensor interface
5 Volt interface with I/O devices
Considering the above requirements, Arduino Uno controller is selected for execution of project work.
Following key features of Arduino Uno are used
Microcontroller: ATmega 328
Operating Voltage; 5V, as all the sensors used are operating at 5V level, they can be directly interfaced with Arduino
Supply voltage: 7 – 20V, GSM module used in project requires 12V supply for its operation, so a single source of 12V becomes sufficient without requirement of the additional voltage regulator.
14 digital I/O pins
6 Analog input pins

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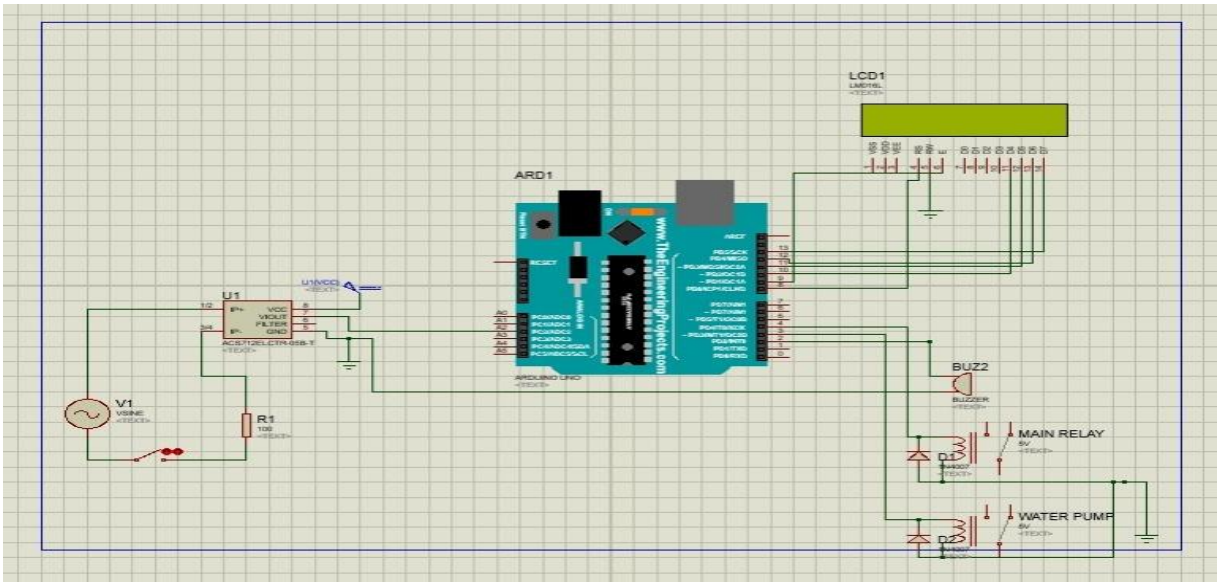
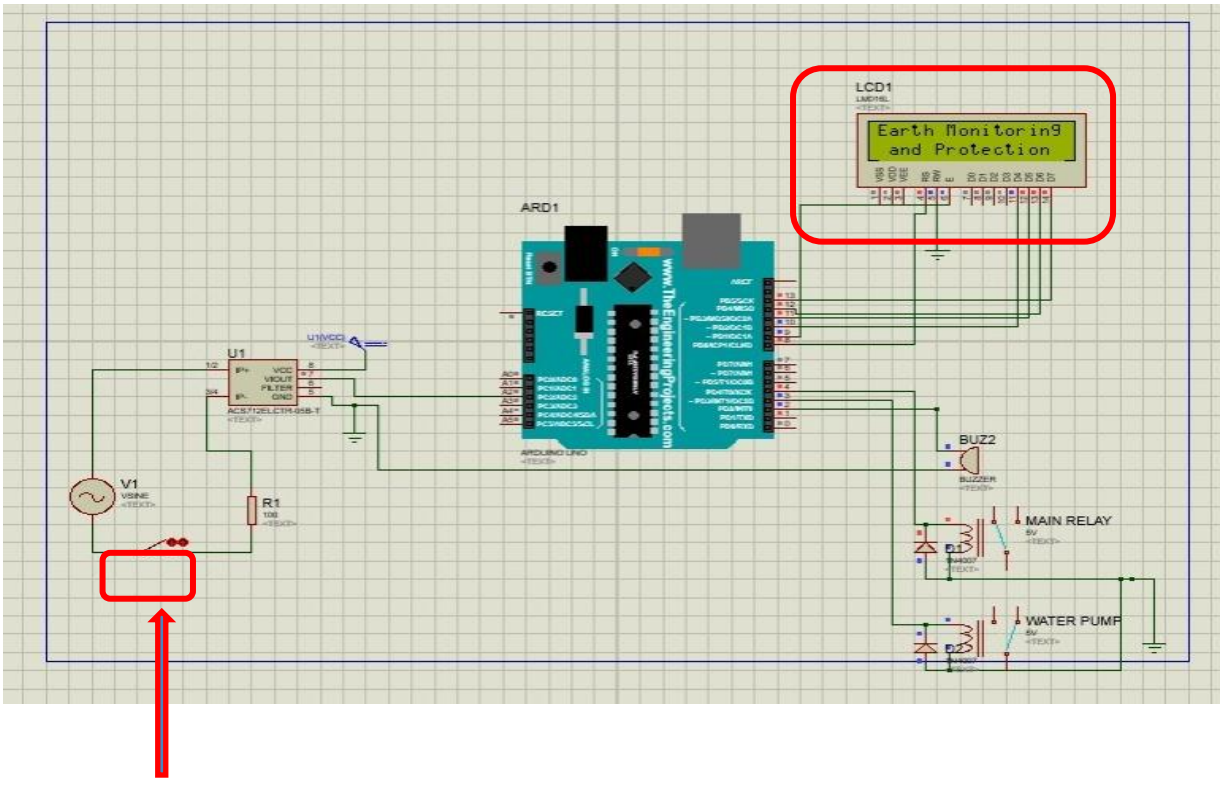
6 configurable PWM outputs; used for speed control of motor
Serial, I2C communication support
Software serial supported libraries
Libraries for easy hardware interface
32KB programmable flash memory
Clock speed: 16 MHz

## V. MATLAB SIMULATION OF EARTHING SYSTEM

### Condition 1 : Off Condition




### Condition 2 : Switch OFF



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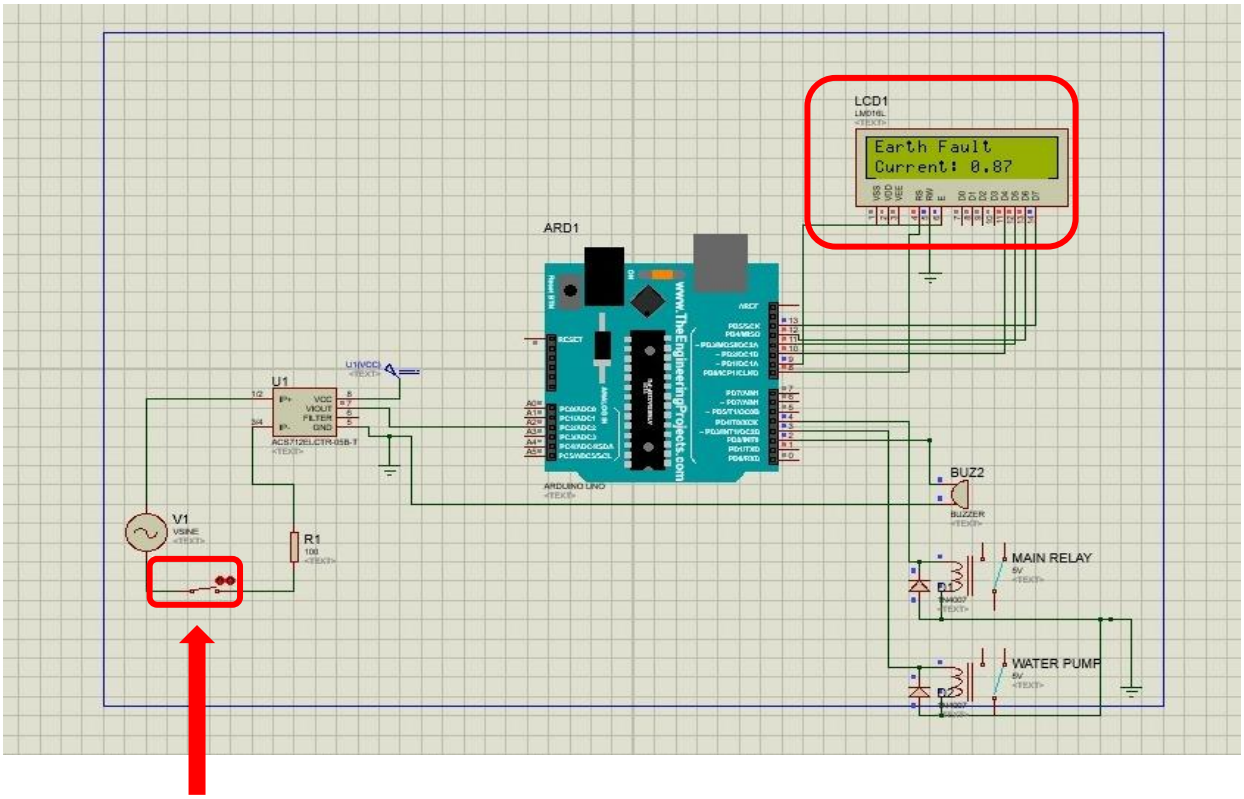
**Condition 3 : Switch ON**




**Condition 1 : Simulation Not Started**
State: Initial state, where the system has not been powered or simulation is idle.
Input Status: No input is provided because the simulation is not running.
LCD Display: No output or message is visible on the display.

**Condition 2 : System Powered (Switch OFF)**
State: Monitoring system is active. The simulation is running, but no fault or leakage is detected.
Input Status: Normal operating condition. No abnormal current flows through the circuit.
LCD Display: Displays the project title "Earth Monitoring and Protection".

**Condition 3 : Earth Fault Detected (Switch ON)**
State: Fault condition triggered due to a detected earth leakage current.Input Status: Abnormal current flow (e.g., leakage) is identified when the switch is turned ON.
LCD Display: Displays "Earth Fault" along with the leakage current value (e.g., 0.

## VI. CONCLUSIONS

Developing an earthing system health monitoring and alert system helps make electrical systems safer and more reliable. By constantly checking the earthing system, it can quickly find any issues and send alerts to prevent accidents and damage. This system also helps with maintenance by spotting problems early, reducing the chance of major failures. Overall, it ensures a safer working environment, reduces downtime, and keeps the system in line with safety rules and standards.

## REFERENCES

1. Rahul S. Bansod1, Shubham A. Bhoyar2, Yogesh M. Gaidhane3, Naval G. Mahure4, Rohit V. Charde5, Prof. H.P. Thakre6," Remote Monitoring of Earthing System", International Journal of Advanced Research in Computer and Communication Engineering Vol. 9, Issue 4, April 2020
2. Rahul Agarwal1, Swati Gade2, M. Ahfaz Khan3 and Nagendra Singh4,"Bibliographical Review of Monitoring and Controlling Technique for Earthing System ", International Journal on Emerging Technologies 14(1): 23-29(2023) .

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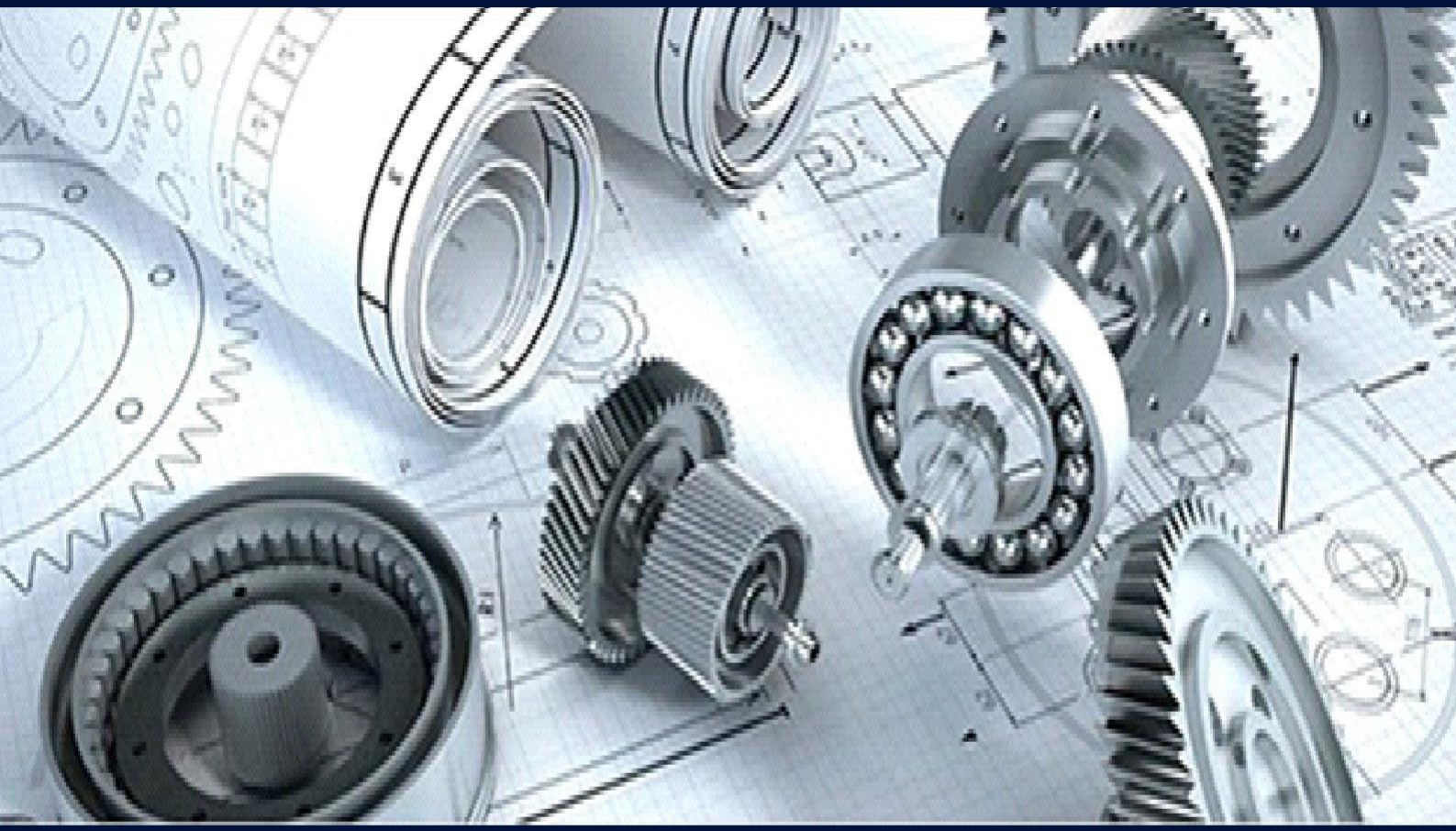
3. M. Irfan Jambak, Hussein Ahmad .“Measurement of grounding system resistance based on ground high-frequency behavior for different soil type”. IEEE Tencon, 3, 207-211 (2000).
4. Yousif El-Tous and S. A. Alkhawaldeh (2014). An Efficient Method for Earth Resistance Reduction Using the Dead Sea Water. Energy and Power Engineering, 6, 47-53.
5. Kojovic, L. A., T. R. Day and H. H. Chu . “Effectiveness of restricted ground fault protection with different relay types”, IEEE power engineering society general meeting, 4, 2134-2139 (2003).
6. Xun Long & Ming Dong . “Online Monitoring of Substation Grounding Grid Conditions Using Touch and Step Voltage Sensors”, IEEE Transactions on smart grid, 3(2), 761-769 (2012)
7. Hans, R. Seedher, J.K. Arora “Estimation of two-layer soil Parameter using finite Wenner Resistivity Expression” IEEE Transaction on Power Delivery, 7(3) (1992).
8. Shintaku Kawakubo, Kishimoto, Minakuchi, and Ochiai "Lightning Protection in Telecommunication Buildings", Proc. of INTELEC98, 697- 702 (1998).
9. Chen, T. H. and Yang, W. C. “Analysis of multi-grounded four-wire distribution systems considering the neutral grounding”, IEEE Transaction Power Delivery, 16, 710-717 (2001).
10. G.Parise, M.& Lucheroni . “Measurements of Touch and Step Voltages Adopting Current Auxiliary Electrodes at Reduced Distance”, IEEE Transactions on Industry Applications, 44(6), 191-198 (2008).
11. IEEE (1989). “Guide for the Application of Neutral Grounding in Electrical Utility Systems”, Part II-“Grounding of Synchronous Generator Systems” ,IEEE Std C62.92.20, pp. 1–24, Sept 1989.
12. N. Harid, A. Bogias, H. Griffiths, S. Robson, and A. Haddad . “A Wireless System for Monitoring Leakage Current in Electrical Substation Equipment”, IEEE access, 4, 2965-2975 (2016).



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