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Electrocution Prevention Using IoT

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Abstract: As you know nowadays there are many electric shocks happening due to negligence of electricity authorities. Recently, in A.S. Rao Nagar, there was an incident where a small boy got an electric shock from the transformer near his home. This happened because current was passing through water lying near the transformer. So, now the authority fixed a mesh around the transformer. But as we know current can pass through water, that mesh may not stop the conduction of electricity. Not only this accident, but there are also many cases of Electrocutions happening in India and other countries as well. So, to stop this type of electrocution we have designed this device which indicates the authorities in those situations to save people's lives.
Keywords: Electrocution, Arduino Uno, GSM.

I. INTRODUCTION

An electric current traveling through the human body causes electric damage, which is a physiological reaction. The security and reliability of the electrical energy system are now more vital than ever. Electrocution is defined as death or major harm caused by an electric current traveling through the body, another word for it is unintentional death. Electric shocks are most caused by physical contact with electrified wire or equipment. Physical contact with energized wiring may not be necessary to cause electric shock when exposed to high voltages, such as at a power transmission tower, because the voltage may be sufficient to jump the air gap between the electric device and the victim. Small currents might go unnoticed or cause skin tingling [1]. A shock that is usually harmless but is caused by a low current. Stronger currents can induce discomfort or misery, and even more, powerful currents can trigger involuntary muscular spasms, preventing the patient from fleeing the electrical source [1]. Electric shock and breakdown can be avoided with the technology we offer. The current is sensed by the Arduino microcontroller, which then transmits a message to the GSM module.

The GSM module sends signals to the appropriate authorities and sounds alarms to alert anyone nearby. As you may know, electric shocks are common these days due to the incompetence of power authorities. A young child has recently been A.S. I was electrocuted by a transformer near my home A.S Rao Nagar. The boy was electrocuted as electricity passed through the water near the transformer. The government has now built an iron fence around the transformer. However, because electricity can flow through water, the grid may not be able to prevent electricity from flowing through it. Not onlydid this disaster occur, but there were also some cases of electrocution in India and other countries. To prevent electrocution, we have developed this gadget that warns authorities in these cases and allows them to save lives [2].

In an electrocution incident, a full circuit is made when a component of the body is attached to two conductors or a conductor and a grounding source, resulting in electrical shock. Electrical mishaps cause around $12,306 crores in property damage to homes and businesses each year. Our proposal proposes a more effective approach to this problem. Using the recommended technique, electric shock and mishaps can be prevented. The electric shock is detected when a human is electrocuted, and the signal is then communicated to the microcontroller through an RF transmitter and receiver. The RF receiver's signal is received by the Arduino microcontroller, which transmits an instruction to a relay, which trips the main board [3].

The alarm then goes off, alerting everyone in the vicinity. It also uses GSM to send an alert message to an authorized individual or the electrical department. The exact position and time information may be obtained using IoT technology, and the electric shock data canbe saved for data records to prevent repeat mishaps. Thisproposed technique aids in the identification of electric shocksand the avoidance of dangerous circumstances in the home or workplace, saving lives [3]. To address these issues, a GSM-based power transmission monitoring and fault detection system is described. There are a variety of existing systems to choose from, but each has its own set of electrical application limitations. GSM technology was used to provide a cost- effective, solid, and stable connection since it enhances communication speed regardless of location [4].

By comparing the current felt with the pre-set limit, a break in the pre-set short circuit limit is monitored. The Arduino UNO Microcontroller sends a signal to the GSM module to cut off the system if the current measured exceeds the pre-set current short circuit limit; otherwise, the system stays connected. When the specified short circuit limit is exceeded, the system sends a fault detection SMS notification to the utility cellphone, allowing bi-directional interaction. The system mayalso receive directives to set a short circuit limit via the utility phone. This technology enables for a near-real-time monitoring system. However, massive power losses exist inthe electrical industry, from generation to distribution. [4]. Transformers, circuit breakers, relays, panels, and other electrical equipment must all be in good working order. Unless the situation is severe, when electrical transmissions are disrupted by a malfunction, they are frequently ignored. These flaws, no matter how little, can cause damage to power system equipment and put people in danger. To better monitor power transmission characteristics, a GSM-based monitoring and fault detection system is proposed. By including fault detection, the system may be quickly isolated from even the tiniest issue. As a result, maintenance costs are kept under control to some extent. The power transformer, which is at the core of any electrical transmission and distribution system, is used to enhance voltage at the generator's output.

A. *Electrocution*

Electric shock death is defined as death or major harm inducedby an electric current running through the body. The name is derived from the word’s "electro" and "execution," however it can also refer to an unintentional death. The term "electric shock death" was introduced in the United States in 1889, just before the electric chair was first used, and initially referred to only accidental or suicidal electricity runs. It did not mean electrical death. However, because there is no English word that can be used for non-judicial electrocution, the word "electric shock" eventually took over the role of explaining all electrical death situations with new commercial power.

Symptoms of electrocution depend on many factors. Low voltage shock injuries are most likely superficial, but prolonged exposure to current can cause deeper burns. After an electric shock, damage can occur as a result. A person can react by bending over, which can lead to imbalances and falls, injuring other parts of the body.

Short-term impact depending on the severity of the electricshock, the immediate effects include:

· Burns
· Cardiac arrhythmia
· Seizures
· A tingling or tingling sensation
· Loss of consciousness
· Headache

Some people notice an unpleasant sensation but no obvious physical damage, while others have severe pain and obvious tissue damage. People who do not have serious injuries or heart problems within 24-48 hours of electric shock are less likely to develop them.

More serious consequences that may include:

· Coma
· Heart Attack
· Respiratory Arrest.

Figure 1: Electrocution Stats in India

B. Problem Definition

When electricity leaks, it causes substantial damage to appliances as well as injury and death to humans. Our proposed technique, which uses GSM and the GPS module, solves this problem for individuals and saves lives.

C. Objective of Project

To design and build a system that will activate an alertwhenever water is detected near a power transformer tower, alerting neighbors and the energy department. The GSM module is attached to the Arduino microcontroller. The GSM module sends the message to the authorized individual. In the future, we can utilize IoT to store data records and replace the GSM module with IoT that can send messages via cloud services.

II. RELATED WORK

Reliability, disconnection speed, and cost are three criticalqualities for such power system protection systems, according to relevant literature in this subject. A key concern in this context is water detection near electrical transformers and alerting the appropriate authorities to preserve people's lives. Many devices have been developed to detect electrocution in industries and factories. These devices are used to detect excessive currents and short circuits in power supply units and then alert the appropriate factory authorities to prevent mishaps. The suggested gadget is used to detect water near power transformers so that no one is harmed when they approach them since the current travels through the water and humans may be damaged by the high currents. To protect people from such mishaps, our technology is used to detect water near transformers and then notify the appropriate authorities and individuals in the area.

Existing work is developed and implemented in such a way that if an electric shock occurs, an alarm is activated to alert neighbors. The signal is sent to the RF receiver through an RF transmitter. The Arduino microcontroller is connected to GSMand GPS devices. With the aid of GSM, GPS tracks the location [6]. They are identifying and correcting defects in electric circuits using some transmission characteristics in this project. They are tripping the power supply in this project if there are any voltage fluctuations, and they are delivering the message using a GSM module [7]. The authors used a three- phase approach to identify voltage loss in transmission in this study, but it was too complicated to apply. They used power transmission techniques to identify power loss or voltage loss during transmission, but it was ineffective and expensive to execute [8]. This study was conducted to determine the frequency of electrocution-related deaths in Nagpur, with a focus on the circumstances surrounding the deaths as well as the pattern of injuries experienced by the victims. This study looked at medical-legal autopsy cases with a history of electrocution from 2012 to 2013 [9].

III. EXISTING SYSTEM

The Arduino microcontroller detects the electric current, and the microcontroller then transmits the control to a relay, which trips the main board. The precise location and timing information may be determined using IoT technology. The alarm then sounds as a warning to adjacent users.

When a person becomes electrified and is discovered. It isthen broadcast using an RF transmitter. The signal is received by the RF receiver and sent into the microcontroller as an input. The microcontroller causes the main broad to drip by using a relay. The message is then sent to the authorizedindividual via GSM module, and an alarm is triggered. GPS is used to determine location. A microcontroller is a miniature computer with a CPU core, memory, and programmable input and output peripherals on a single integrated circuit. Microcontroller boards are interactive digital devices that can detect and control objects. Microcontrollers are employed in products and systems that are automatically controlled.

IV. PROPOSED SYSTEM

The suggested technology detects the presence of water near the transformers and notifies the appropriateauthorities and residents. When the sensor detects water near the transformer, it measures both the water and the voltage and passes the information to the microcontroller. The microcontroller then transmits the command to the GSM module, which delivers the message to the authorized individual and sounds the alarm.

A microcontroller is a miniature computer with a CPU core, memory, and programmable input and output peripherals on a single integrated circuit. Microcontroller boards are interactive digital devices that can detect and control objects. Microcontrollers are employed in products and systems that are automatically controlled

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A. Hardware Description

1) *Arduino UNO:* Arduino Uno is an open-source microcontroller, in our proposed project we are using it for programming the circuit. Arduino is a free and open-source electronics platform that includes both hardware and software. Arduino boards can detect input such as light from a sensor, a finger on a button, or a tweet and convert it to an output such as turning on an LED, starting a motor, or sending a tweet. You may provide a series of instructions to the board's microcontroller to tell it what to do. This is accomplished using the Arduino programming language (based on Wiring) and Arduino software (IDE) (based on Processing).

Figure 2: Arduino Uno

Thousands of projects, ranging from basic household items to complex scientific equipment, have used the Arduino throughout the years. This open-source platform brings together a worldwide community of students, hobbyists, artists, programmers, and professionals who have contributed to a tremendous quantity of material that may be incredibly useful to beginners and specialists alike Its operating voltage is 5V, the input voltage can vary from 7-20V. It has 6 analog input pins and 14 digital I/O pins. Its clock speed is 16Mhz.

2) *GSM:* The most frequently used mobile phone standard on the globe is GSM (Global System for Mobile Communication). In 212 countries, GSM is used by more than 3 billion people. International roaming between mobile phone carriers is quite common due to its broad use, allowing users to use their phones in a variety of locations throughout the world. GSM is a cellular network; therefore, phones connect to it bysearching for nearby cells.

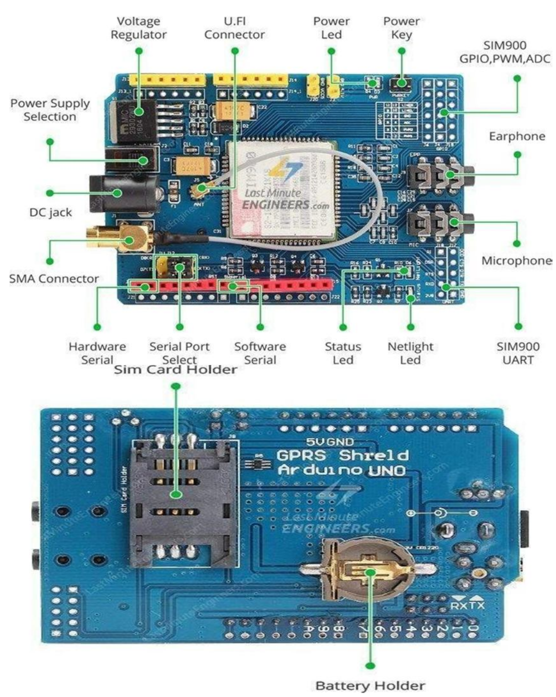

Figure 3: GSM Module – SIM 900

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There are four frequency bands in GSM networks. The coverage area of each cell varies depending on the implementation environment. Depending on antenna height, antenna strength, and propagation conditions, a cell's horizontal radius can range from a few hundred meters to several tens of kilometers. The GSM network is divided into several sections. The GPRS core network, network and switching subsystems, and base station subsystem are all covered. Many GSM services, such as phone calls and text messages, are created by integrating all of the system's capabilities. One of GSM's most essential features is the Subscriber Identity Module (SIM)

3) *Sensor (zmtp101b):* The ZMTP101B voltage sensor module is a voltage sensor made from the zmtp101b voltage transformer. It has a high degree of precision and consistency while measuring voltage and power, and it can measure up to 250V AC.

Figure 4: Sensor- ZMTP101B

It has a multi-turn trim potentiometer for fine-tuning the ADC output and is simple to operate. This study's regression analysis seeks to find a more precise relationship between the input voltage and the ADC output. When compared to a reference input, the trim pot is utilized to adjust the ADC Output to an acceptable value.
The ZMPT101B AC Single Phase voltage sensor module is based on a high-precision ZMPT101B voltage transformer. The ZMPT101B AC Voltage Sensor is perfect for DIY applications that require precise AC voltage measurement using a voltage transformer.

4) *Buzzer:* A beeper or buzzer is an auditory signaling device that can be electromechanical, piezoelectric, or mechanical. The main purpose of this is to transform an audio signal to a sound signal. It is commonly used in timers, alarm devices, printers, alarms, computers, and other equipment that are powered by DC voltage. It may produce various sounds such as alert,music, bell, and siren according to the varied designs.

Figure 5: Buzzer

5) *LED:* An LED (Light Emitting Diode) emits light when an electric current passes through it. Electrons charge with holes in the LED as current runs across it, resulting in light. LEDs allow electricity to travel in one direction alone, and not the other.

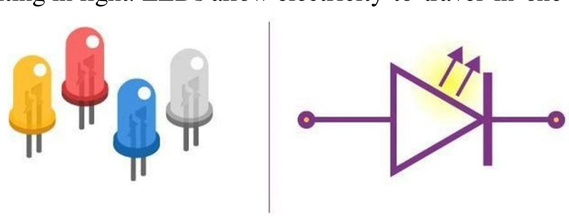

Figure 6: LED

The LED has a strongly doped PN junction. The LED generates colored light with a certain spectral wavelength when forward biased, based on the semiconductor material and the amount of doping voltage employed. To allow the emitted light to escape, the LED is encased in a transparent cover, as illustrated.

B. Software Description

1) *Arduino IDE:* The Arduino IDE is a free open-source program that lets users create code in real time and upload it to a functional environment. Because the code is written in the cloud, it is frequently employed by those who require an additional layer of redundancy. All Arduino-based programming boards are completely compatible with the Arduino IDE.

Figure 7: Arduino IDE

This software is simple to install on Linux, Mac, or Windows platforms. For easy compilation and editing, the majority of its components are written in JavaScript. Although this tool's primary goal is to write code, it does have several noteworthy features

V. ARCHITECTURE

The proposed method will work when energy travels through water and the earth. When an electrical leak occurs, the ZMPT101B voltage sensor will take measurements and compare them to the authorities' established readings. TheZMPT101B sensor would take readings every second and relay them to the Microcontroller. The readings would be compared to the stated readings using the Arduino IDE programmer. The data may be ignored or passed on if the voltage is less than the specified value. The data is delivered to the Microcontroller if the voltage is higher than the measurements. The Arduino software would send a signal to the Microcontroller (Node MC), which would then send the data to the alarm system and GSM module. The information would be given to the GSM Module (SIM 900) by the Node MC, who would then approve the SMS.

The communication is forwarded to the proper officials or authorities after the GSM Module has authorization to relaythe leaking result. At the same time, the data would be sent from the Node MCU to the alarm, which would then activate the sound to alert anyone around. This model has the potential to save many lives. The electric shock is detected when a human is electrocuted, and the signal is then communicated to the microcontroller through an RF transmitter and receiver. The signal from the RF receiver is received by the Arduino microcontroller, which transmits an instruction to a relay, which trips the main board.

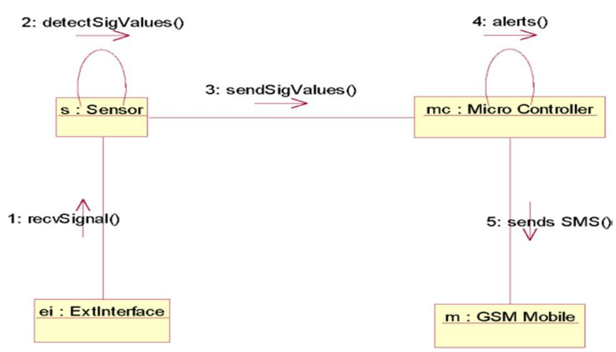

Figure 8: Architecture

The alarm then goes off, alerting everyone in the vicinity. It also uses GSM to send an alert message to an authorizedindividual or the electrical department. The exact position and time information may be obtained using IoT technology, and the electric shock data can be saved for data records to preventrepeat mishaps. This proposed technology makes it easier to detect electric shocks and avert dangerous circumstances inthe home or office, perhaps saving lives.

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Circuit Diagram

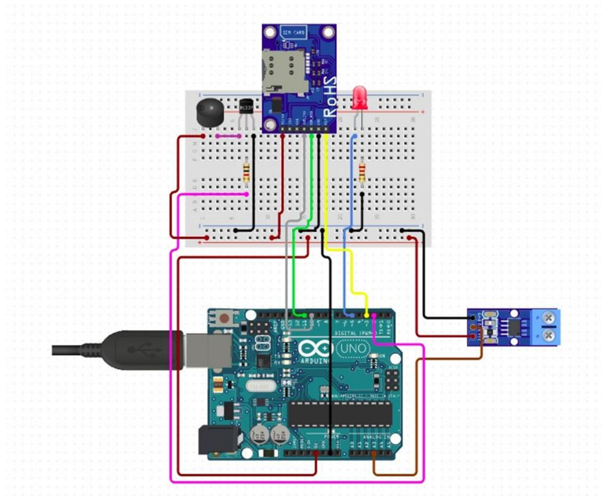

Figure 9: Circuit Diagram

A. Flow Chart

When a voltage or current flows through the water or ground nearby the transformer, the device installed nearby the transformer will first detect the voltage flow and sends the amount of the flowing voltage to the microcontroller.

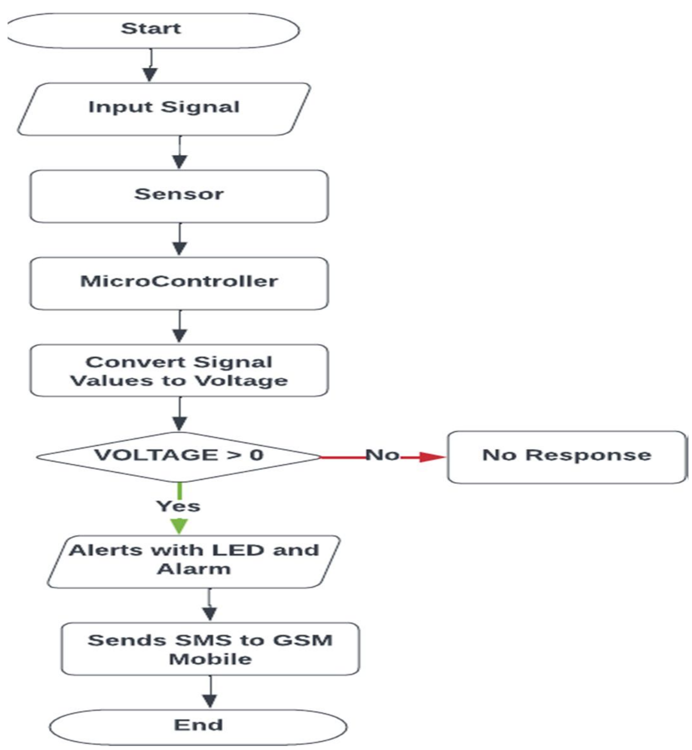

Figure 10: Flow chart

Then it checks the condition, whether the amount of the flowing voltage is more than or less than the condition. If the amount of the flowing voltage is more, it alerts the nearby people with a sound buzzer and LED. And it sends an SMS to the Electricity department along with the location of the affected area. If the amount of the flowing voltage is less, it doesn't alert.

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VI. RESULTS

When the electric current does not pass through the ground or water, then the voltage would be of 0 volts. It sends a messagethat no current passes.

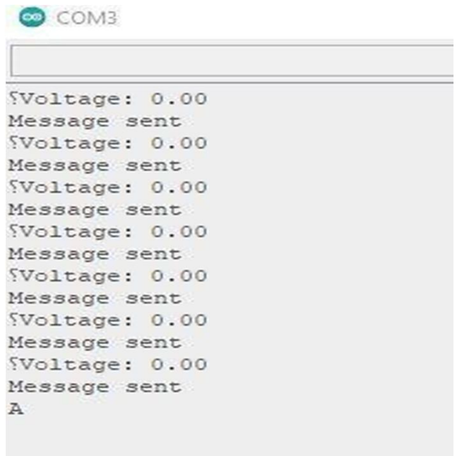

Figure 11: COM Sensor reading

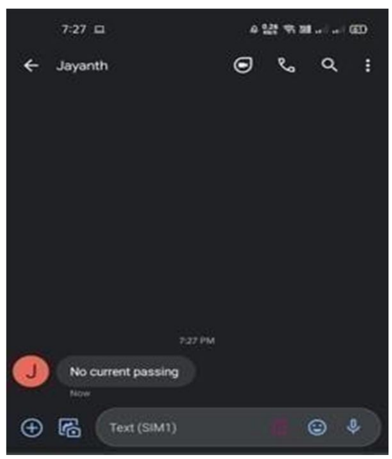

Figure 12: Result of No Current flow

When the current passes through the ground or water near the transformer then the sensor would detect the current leakage and send the information to the respective number with the amount of voltage leak.

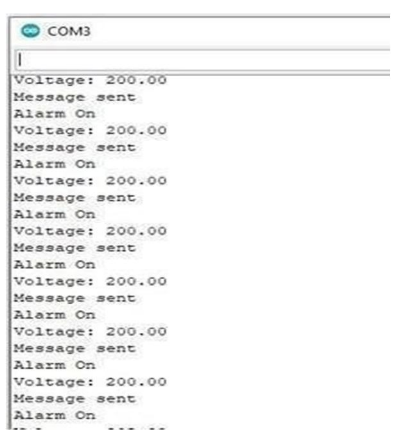

Figure 13: Result of Current Flow

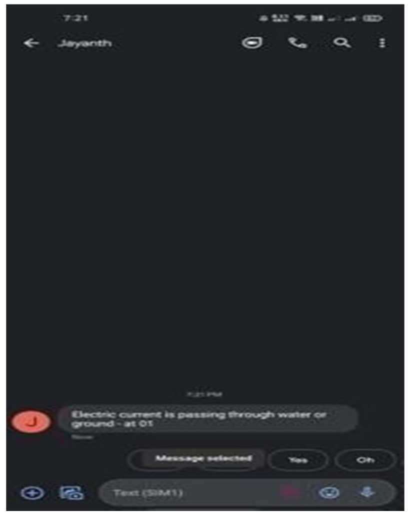

Figure 14: Result of Current flow

VII. CONCLUSION

Thus, the proposed work is designed and implemented in which an alarm is used to intimate the neighbors and whenever water is detected near the power transformer tower respective authorities are intimated. The GSM module is interfaced to the Arduino microcontroller. With the help of a GSM module, the message is sent to authorized persons. In the future we can implement this device using IoT to store data records and we can replace the GSM module with IoT which can send messages using cloud services.

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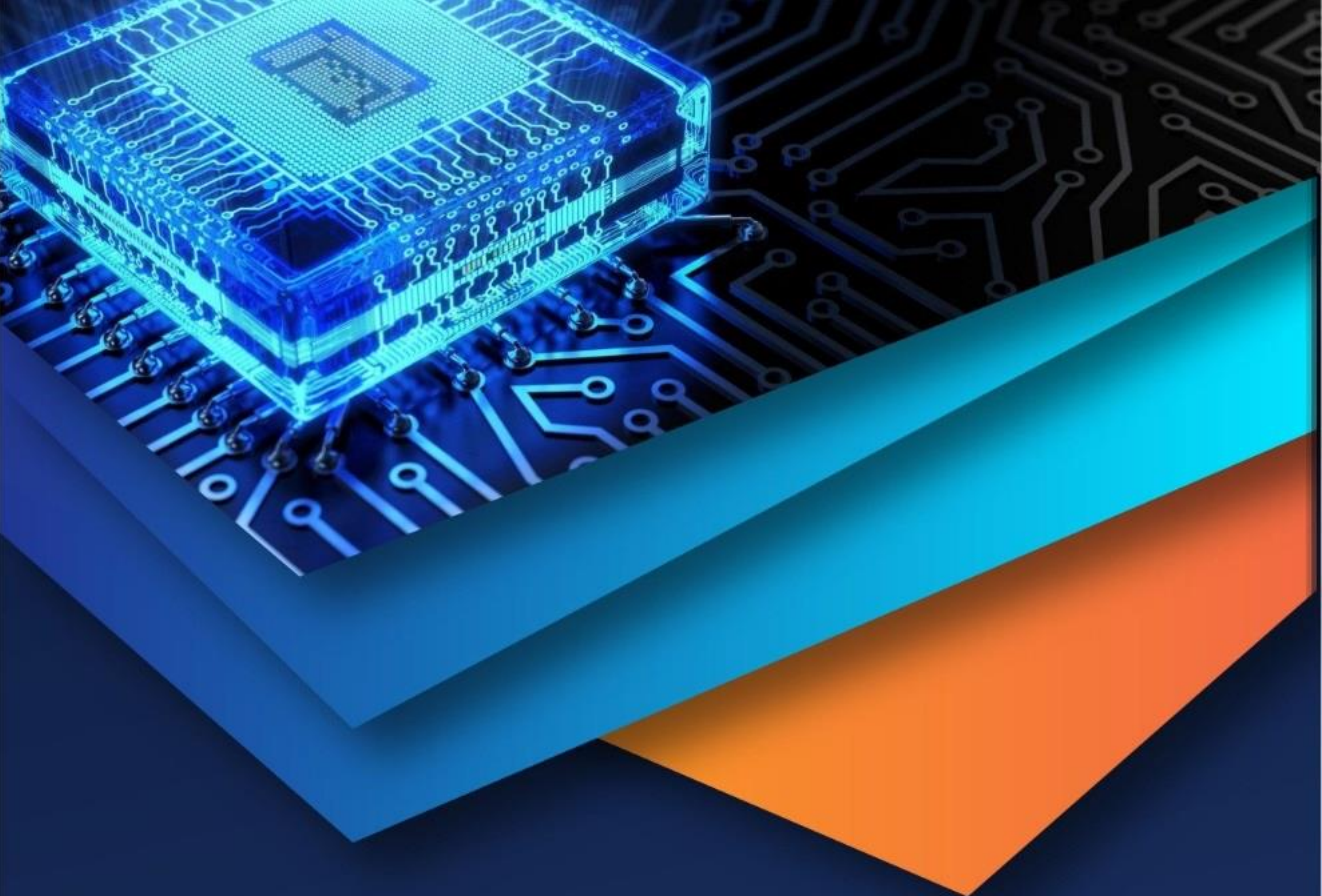

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