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Advance Water Quality Monitoring System using Solar Power

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***Abstract:** As of the growing environmental and water challenge, access to clean water is of paramount importance. Many methods are used of checking the water level with a low cost rating system. Monitoring water quality in various areas as a real application is recommended for low-level channel and sensory areas. Designing and implementing this solar cell model with WSN technology is a daunting task. Third PH sensor (SKU: SEN0169), Turbidity sensor connected to Arduino, GSM and LCD for communication and monitoring purposes. These sensors take measurements of the relevant parameters (PH, Turbidity, and Temperature) and send them to Arduino, where they are shown on the LCD. For monitoring reasons, estimated values are sent through GSM. The solar panel is used to power the system and independently provide a lead battery. This idea is useful when the grid is not available. The benefit of this system is low power consumption, no carbon emissions, which can be easily shipped to a remote location and so on.*

***Keywords:** GSM, Wireless Sensor Networks, Water Quality Monitoring, Solar PV, Industrial Sensor*

I. INTRODUCTION

We know that water is the main source of life for all living things. It is vital for household, industrial, and agricultural customers, yet its abundant resources need that it be kept clean. There would be no life on Earth if it did not have access to water. Water supplies are under jeopardy because they deplete rapidly over time. In the 21st century, there were many new developments, developments, globalization, and then there was global pollution, global warming, and as a result, there was no safe water for the people of the world. The reason for this is the lack of a water quality monitoring system that is causing major problems. Recent research reveals the effects of toxins being released from the river. Drug overdose can cause drug resistance. WQM [7, 8] is critical for the planet's survival.

By studying nine different chemicals that work in the Yamuna rivers, researchers have now shown that they can "create lasting toxins" in reducing the health of water users. Since our body does not use the full amount of the drug we eat, most of it is excreted and ends up in the water system through domestic violence. Uncontrolled emissions from our river and other bodies of water can cause many drug-resistant bacteria, so this emphasizes the need for a system that should be used to monitor water quality in a simple way, so that it can easily analyse other important water features.

Many environmental parameters such as temperature, pH, oxygen concentration, humidity and more in water can be collected by these systems using a variety of sensors. In previous years, the water level was monitored according to the system used, the staff used to collect water sample and test this sample in the laboratory.

This process takes staff process and time. The use of wireless communication technology in current water quality measurement systems is very common. This wireless technology helps transfer data from the sender at the end of the buyer to the recipient at the end of the request.

After reviewing the documentation, it is found that the GSM technology was not used for the implementation of the targeted program. Using GSM, we are able to collect data from remote locations and maintain an effective and efficient record. After the data is obtained, we can analyze and evaluate water quality in terms of weight, pH and temperature. The system is used to measure communication (pH, turbidity, and Temperature) (GSM) and monitoring objectives (LCD). It's a computerised monitor that maintains track of the parameters you choose and sends the information to the user through GSM. Near the water source for testing, the LCD is utilised to present information to the user.

The suggested system's intelligence is controlled by Arduino, which scans screens and provides data to the user. Analyzing water quality data and when water quality is available below a pre-set level, the Alarm automatically opens. A variety of tools are used to simulate integrated data that can be analysed in writing and in future actions.

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II. LITERATURE REVIEW

This research work represent to monitor the quality of water over different sites as a real time application, a base station and distributed sensor nodes are proposed [13]. The design of IOT based water quality monitoring system that monitor the quality of water in real time. System consist some sensors which measure the water quality parameter such as pH, turbidity, conductivity, dissolved oxygen, temperature. It consists of spatially distributed autonomous sensor to monitor water parameters [15, 16]. Work presents the design and development of a low cost system for real time monitoring of drinking water quality at consumer sites [17]. Proposed water monitoring system helps the individuals to keep a track on their water bills and helps the government to manage the water supply and modify billing scheme based on the water usage [18].

WQM for Rural Areas using a Sensor Cloud Based Economical Project work by N. Kedia. The whole water quality monitoring techniques, sensors, and information dissipation procedure, as well as the role of government, have been investigated [19]. Real time WQM system by J. Bhatt and J. Patoliya. They researched the safe supply of drinking water and discovered that the quality should be monitored in real time. We also looked at the design of an internet-of-things-based water quality monitoring system [14]. QOI-Aware Energy Management in Internet-of-Things Sensory Environments by Z. Sun, Chi Harold Li, C. Bisdikian, Joel W. Branch, and Bo Yang. This study investigates an effective energy management framework for providing a satisfying QOI experience in IOT sensory settings [20]. Adaptive edge analytics for distributed networked control of water systems by S. Kartakis, W. Yu, Reza Akhavan, and Julie A. McCann. The burst detection and localization technique for water distribution networks was investigated. When compared to regular weekly reports circumstances, it can save up to 90% on communications [21].

III. WATER QUALITY MONITORING ARCHITECTURES

All living organisms on this planet require water to survive. In monitoring water quality, oxygen levels play an important role in water. Human, plant and environmental health problems depend on water quality Rain, rivers and lakes are many sources of water. Rainwater runoff in countries contains a lot of useful and harmful content, and it can be soluble or insoluble. Low salt determines the acidity of the water. The insoluble particle mixed with water reduces water consumption in some applications, while the traditional measurement of water quality is simple. The main aim is to calculate the oxygen level, turbidity and acidity of water which is used in agricultural purposes. In the supervision with remote access and by using wireless communication provisions internal control we can calculate the water quality measurement parameters on the other hand at the base station data can be monitored using simulation software and also will be recorded. The parameters are oxygen level, pH and turbidity that are examined and control to improve water qualities. Flow chart shows the whole process of system architecture.

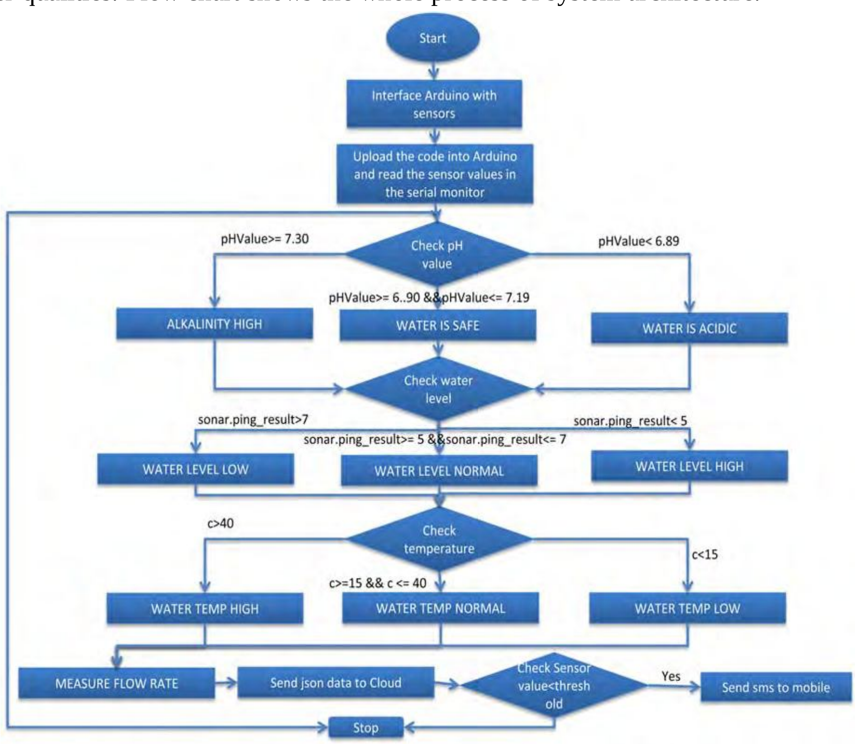

Fig.1 Flow Chart of proposed system

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A. The objectives of idea execution are as follows:

1) Oxygen, pH, and turbidity of water are measured using sensors at a remote location.
2) To use solar power to provide local power to sensor nodes.
3) To combine data from multiple sensor nodes and address it to base station through wireless channel.
4) To ensure that digital communication between source and sink nodes is synchronised.
5) For internal control, simulate and check quality parameters.
6) To create a web-based record for further evaluation and public information on water resources.

IV. HARDWARE AND SOFTWARE COMPONENTS

GSM modules, Buck Converter, PH sensor, Turbidity Sensor, Liquid crystal display, Lead-acid battery with a valve regulator (Rechargeable Battery), Arduino UNO, Photovoltaic solar Module, and Temperature Sensor are among the hardware components used in the system.

A. GSM Module

This module is used for communication purposes SIM900D is employed, it makes the recommended system wireless. GSM is an open and digital cellular technology that uses the 850MHz, 1800MHz, and 1900MHz frequency bands to deliver mobile voice and data services. For communication reasons, GSM technology was created as a digital system utilising the time division multiple access (TDMA) approach. To receive and transmit data to the user, GSM is linked to Arduino.

B. Solar PV module

The photovoltaic solar module was used to charge a battery that delivers consistent power to all elements of the designed method, resulting in environmental sustainability. The system is self-contained and simple, and it can be rented in off-grid places. Fig. 2 The diagram depicts a water monitoring system that uses solar PV and GSM. The figure depicts all of the pieces that fulfil the required functions. The Solar PV module charges a battery, which ensures that all things have continual power. All of the system's sensors feed data to the Arduino, which then sends the data to the GSM for display built-in software is used to describe many nodes and base stations. This approach is used to track water quality in different areas and send data to at least one basic station. We will use the entire system after designing this prototype and setting the nodes. By looking at the specifications of the GSM module, water quality may be regularly monitored in various locations away from the substation.

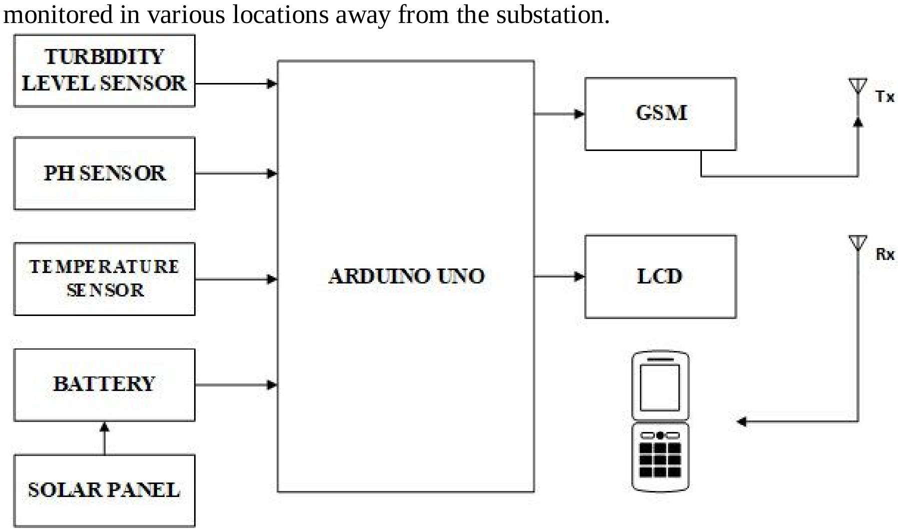

Fig.2 Block Diagram of proposed system

C. Arduino UNO

The ATmega328p is mounted on a microcontroller operational board of the Arduino Uno. There are six digital input/output pins, fourteen digital input/output pins, a 16 MHz quartz, an impact jack, a USB connection, a pressure button, and an ICSP head. It has a simple circuit that the microcontroller must use to control something. A Valve Lead Acid Battery supplies power to the Arduino Uno (12V). To make a microcontroller system, we utilised the Arduino IDE programme. The microcontroller sends and receives signals in response to the command. The Arduino is the project's heart, connecting the sensor module, LCD, and GSM. By displaying the purpose and GSM channel data transfer module, you may receive sensor signals and send LCDs.

D. Sensor

Sensor availability is essential in the water quality monitoring system. Sensors are critical to the system's automation. Without their help, the system could not be set up as it is. To measure three separate variables, three different sensors are used. Table 1 shows a list of sensors and their usage.

TABLE I
various sensor used in water monitoring

S.NO.	Sensor Name	Usage
1.	SEN0169	pH Sensor
2.	SEN0189	Turbidity sensor
3.	DS18B20	Temperature sensor

The analogue pH sensor SEN0169 is what it's called. It measures the pH of water from 0 to 14. Internal communication is simple, easy, effective, and long-lasting (up to a year), making the system excellent for remote monitoring. BNC connector, PH2.O interface, and power indicator LED It is physically sound and has a speedy response time of only one minute. The output power is linear in the pH range of 0 to 14. It takes 5 volts from the Arduino and directs it to the estimated pH value in the Arduino in order to keep it functioning. The turbidity sensor sen0189 measures metal levels to identify water level.

It measures the rate of solar transmission and the rate of dispersion, which both increase with the degree of density (TSS) in water, to detect fixed particles in water. The level of turbidity rises as the TSS rises. It operates at 5 volts DC and has a response time of less than 500 milliseconds. It directs the Arduino's estimated values in the future. The DS18B20 temperature sensor is a single digital temperature sensor. It can detect water temperatures ranging from 55°C to 125°C, ensuring that water is not contaminated. It recognizes the significance of heat and refers to Arduino throughout the process. These sensors are frequently used to determine whether or not the water is safe to drink. These sensors work in an open environment with significant temperatures that are critical for the proper operation of changing conditions.

V. IMPLEMENTATION OF WATER QUALITY MONITORING

Recognize and apply is the appropriate rule of thumb in implementation methodology. The suggested system is broken down into sub-systems that can be used in stages. The solar and battery system is the first underground system. The solar system converts daylight into electricity, which is then stored in the VRLA, a rechargeable battery. Because electricity is always available, a rechargeable battery is used after that. A sensor network is the second lowest system. The Arduino board is controlled by the brain system and receives values from all sensors. LCD and GSM are on the third floor layout. The data was shown on an LCD screen, and information was transmitted to the user through GSM. The relationships between the system's components are represented in Fig. 3.

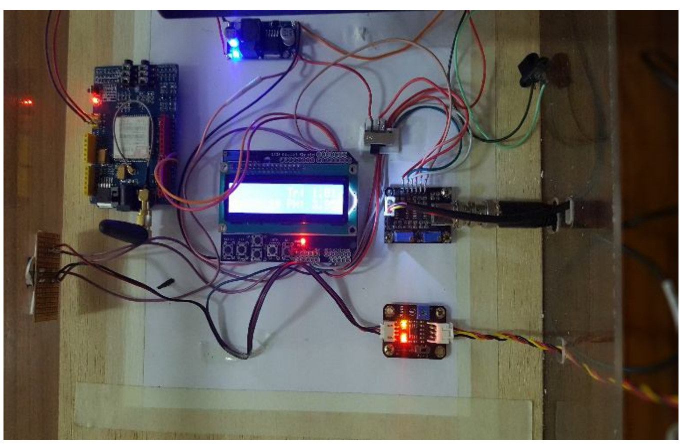

Fig.3 Block connection diagram of the emission monitoring

Fig. 4 depicts the overall system's kind of system. Many researches are constructed with a single base channel that may hold a record for all nodes. This research method is frequently recommended as a unique programme as a result of this arrangement. The text message is generally received through GSM anywhere in the globe, and the results are shown on the LCD.

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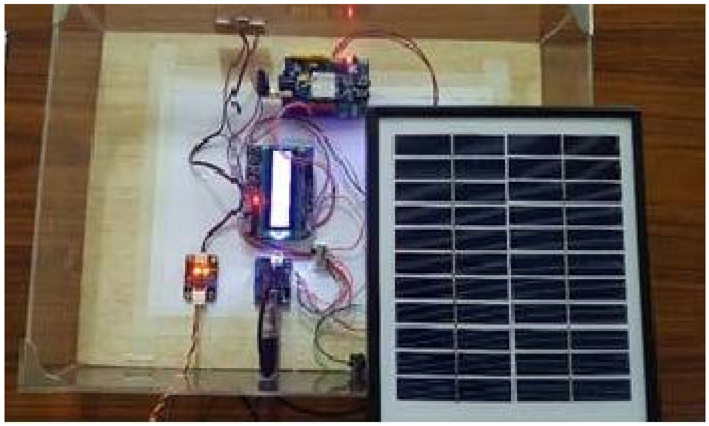

Fig.4 The constructed system prototype

VI. RESULT AND DISCUSSION

On the LCD display, Fig. 5 shows the values of the measured data. The letter "Tr" stands for "level of adjustment." In this experiment, the standard amount of fluid fluctuations was utilised about two times. According to the aforementioned findings, the perceived response has a lower level of annoyance. As a result, rather of utilising high humidity filters that utilise more filter paper, we will filter this water via a filter plant at a cheaper cost. Because the pH of water changes with temperature, the letter "W" denotes the reaction temperature. The pH (acid ratio) of the monitoring solution is shown by the word "pH" in Fig. 5.

Fig. 5 Result data displayed on LCD

Keeping the water in the pool of a healthy water filter at the proper level is self-evident. The water level in your pool scheme should be one-third higher than when it first opened. The water should, however, be at the same level and point as the designer's technique of opening. We are unable to instal our system on lake manufacturers to monitor water quality because it is not water proof at this time. Instead, we buried it above the water, yielding a 125cm value.

Industrial wastewater is usually 6.5 to 8.5. Our waste water sample also provided a minimum pH of 5.5. It is therefore unsafe to drink or use this water for domestic purposes. We may calculate the water used for different purposes using the flow sensor, such as composing, washing, processing, chilling, decreasing, or transporting the product; adding water to the product; or sanitation requirements within the manufacturing facility, to increase water and decrease expenses. Surface water is contaminated and drinkable if the pH range is 6 to 8.5. The temperature of regular tap water should be approximately 13 degrees Celsius, whereas the temperature of hot tap water should be around 50 degrees Celsius.

VII. CONCLUSIONS

Many sensors are utilised to measure pH, temperature, and water pressure in this study. These sensors detect water quality in a remote location where manual readings may be taken on a regular basis. This information is then analysed by Arduino and delivered to a user anywhere on the planet through GSM. The long-term sensor node is powered by a solar PV module. The LCD shows a number of indicators of water pollution. Water, small industry, agriculture, and household usage are all common applications for the system. Consequential sequence from the state of pollution in a remote region is often maintained by monitoring water quality and collecting complete data. The system not only provides a comprehensive assessment of the aquatic environment but can also quickly detect emergency hazards or natural disasters, transmit unusual water quality data to a monitoring network through a fast communication network and provide departmental drawing drawings that make the choice to understand the nature of disaster prevention and treatment.

This research paper is expanded into an effective local water management system. The truck will be connected to a water pipe and will be in charge of controlling the flow of water from one carrier to the next. We can cut down on our water usage this way. In addition other parameters that were not highlighted in this paper such as noise and electronic performance can also be counted. Therefore an additional budget is needed to develop another system. It can also be used to create a mobile remote water monitoring application that the user can download and install on his device and can receive real-time notification. Next to replace this used flow sensor with a measuring capacity of up to 30 ml of water, we have another model that will measure 60 ml of water accurately. Keeping embedded devices in the environment for monitoring allows the environment to self-protect (i.e., smart environment). This will need the deployment of sensor devices in the environment for data collection and processing. We can bring the environment to life by putting sensor devices in it, allowing it to communicate with other things through the network. The end user will then have access to the collected data and analysis findings through Wi-Fi.

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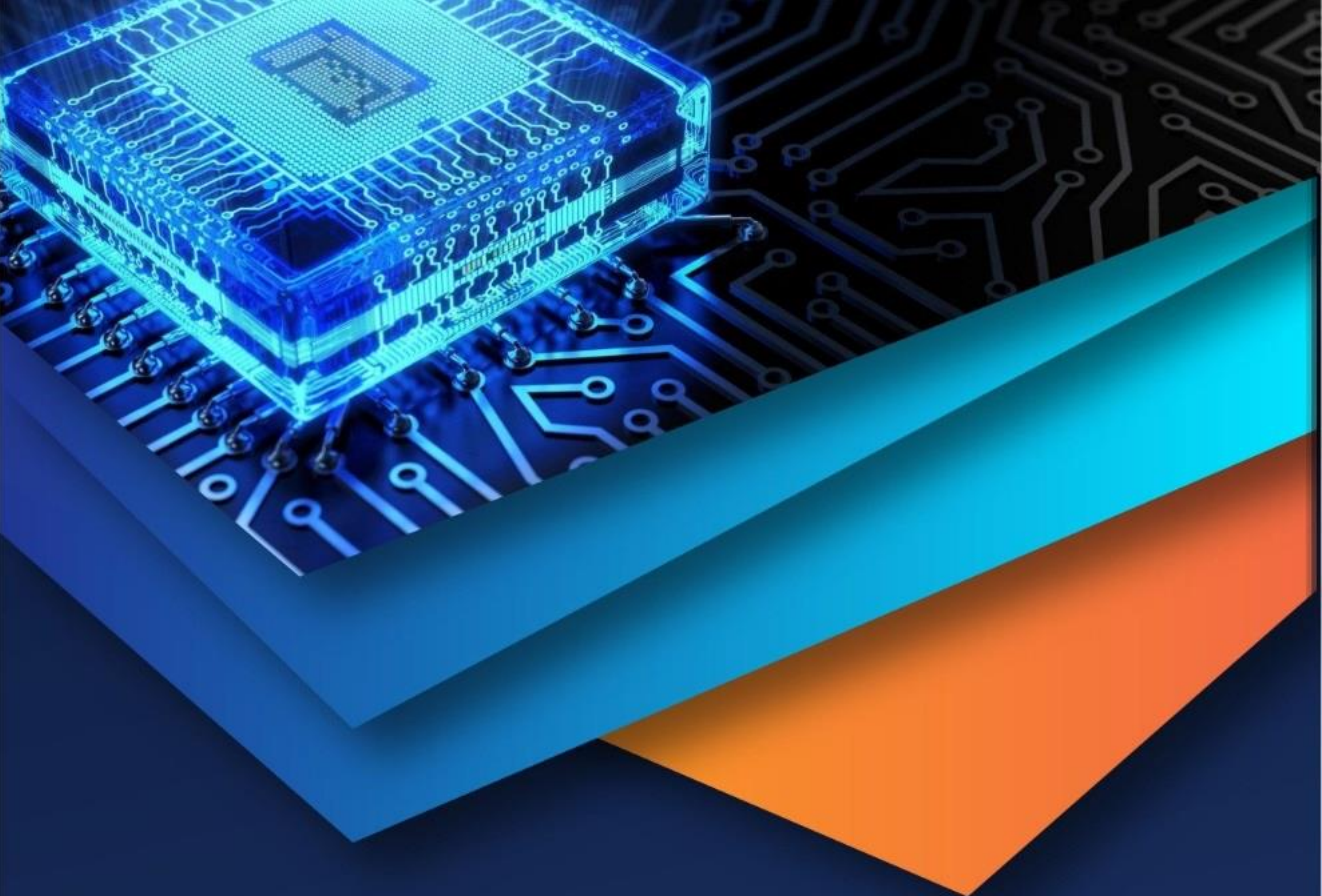

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