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AI Assisted Engine Oil Monitoring System

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Abstract: This study presents a pioneering solution aimed at elevating the performance of two-wheelers through the integration of real-time engine oil and fuel level monitoring systems. Recognizing the critical role of these components in determining vehicle efficiency, longevity, and overall user satisfaction, the proposed approach leverages state-of-the-art sensor technologies and connectivity solutions. The real-time engine oil monitoring system constitutes a groundbreaking aspect of this research, employing advanced sensors to continuously assess the quality and viscosity of the engine oil while the vehicle is in operation. The collected data undergoes analysis through sophisticated machine learning algorithms, facilitating the identification of potential issues such as oil degradation or contamination. By providing riders with immediate feedback on the engine oil's condition, the system empowers them to undertake timely maintenance measures, including prompt oil changes. This not only contributes to the extended lifespan of the engine but also enhances overall performance. Simultaneously, the fuel level monitoring system utilizes cutting-edge sensors to accurately measure the remaining fuel in the two-wheeler's tank. This real-time data is communicated to the rider through an intuitive interface, offering precise information on the fuel level and estimated range. This empowers riders to plan their journeys more effectively and contributes to fuel efficiency by minimizing instances of running on low fuel, thereby optimizing refueling intervals.
Keywords: Two-Wheeler performance, Engine-oil monitoring, Fuel level monitoring, IOT System, Sensors

I. INTRODUCTION

In the dynamic landscape of transportation, characterized by continual advancements and a growing emphasis on efficiency, sustainability, and user experience, the role of two-wheelers has become increasingly pivotal. Motorcycles and scooters serve as nimble and convenient modes of urban mobility, navigating through congested streets and offering an alternative to traditional four-wheeled vehicles. Recognizing the significance of these two-wheelers in the modern transportation ecosystem, this project sets out to propel their evolution through the development of a groundbreaking solution: Real-Time Engine Oil Monitoring and Fuel Level Monitoring.

The fundamental objective of this initiative is to elevate the performance, longevity, and safety of two-wheelers by integrating cutting-edge technology into their operational framework. The core components of this innovative system revolve around harnessing the power of real-time data analysis and intelligent monitoring. Unlike conventional approaches to maintenance and monitoring, which often rely on periodic checks and manual assessments, this project seeks to implement a continuous and proactive monitoring system.

By doing so, it aspires to redefine how we manage and optimize the operation of two-wheelers, ushering in a new era of efficiency and reliability.

Real-Time Engine Oil Monitoring is a key feature of this project, addressing a critical aspect of two-wheeler maintenance. The engine oil in any vehicle serves as a lifeblood, ensuring smooth operation and preventing wear and tear. In the context of two-wheelers, where the engine is compact and operates at high RPMs, the health of the engine oil is paramount. The proposed system will employ advanced sensors and data analytics to monitor the quality and quantity of engine oil in real-time. This proactive approach allows for timely interventions, such as oil changes or system adjustments, thus extending the lifespan of the engine and reducing the likelihood of unexpected breakdowns .Complementing the engine oil monitoring aspect is the integration of Real-Time Fuel Level Monitoring.

Efficient fuel management is not only crucial for the economic operation of two-wheelers but also contributes significantly to environmental sustainability. The system will incorporate sensors that provide accurate and real-time information about the fuel level, enabling riders to plan their routes and refueling stops more effectively. This not only enhances the overall user experience but also reduces fuel wastage and emissions, align with the global push towards greener and more sustainable transportation solutions

II. OBJECTIVE

The main objective of our project is to

1) Ensure the system delivers accurate measurements of oil levels, quality, and condition to reflect engine health reliably.
2) Implement continuous monitoring to track oil levels, viscosity, contaminants, and other parameters in real-time, enabling swift detection of abnormalities.
3) Utilize AI algorithms to analyze historical data and current trends, predicting maintenance needs for timely intervention and preventing unexpected breakdowns.
4) Design the system for easy integration with existing vehicle or machinery diagnostics, fleet management software, and IoT platforms to enable comprehensive monitoring across fleets or equipment networks.
5) Develop an intuitive interface that provides easy access to oil monitoring data, alerts, and maintenance recommendations, catering to users of all experience levels.

III. EXPERIMENTAL SETUP

The experimental setup for this groundbreaking project is multi-faceted, encompassing key elements that synergistically contribute to the realization of real-time monitoring for engine oil and fuel levels. The first crucial step involves the seamless integration of precision sensors dedicated to monitoring these parameters. State-of-the-art oil level sensors and fuel level sensors are meticulously selected to ensure accuracy and reliability across diverse environmental conditions. These sensors serve as the frontline data collectors, feeding real-time information into a sophisticated Data Acquisition System. This system, equipped with cutting-edge communication protocols, acts as the nerve center, orchestrating the collection, transfer, and processing of data from the integrated sensors.

The heart of the experimental setup lies in the selection of a high-performance Central Processing Unit (CPU) responsible for real-time data analysis. This CPU is entrusted with the task of interpreting the incoming data and providing actionable insights into the engine oil and fuel levels. Furthermore, a seamless integration with the two-wheeler's onboard computer amplifies the system's capabilities, allowing it to access additional parameters for a comprehensive analysis of the vehicle's health and performance. The culmination of these components is manifested in a user-friendly interface, strategically designed to relay real-time information to the rider. This interface, whether integrated into the vehicle's dashboard or accessible through a mobile application, serves as the bridge between the advanced monitoring system and the end user. Finding proper sensor to measure the condition of engine oil was a big task. After that we came to the conclusion that using Turbidity sensor was a better choice. The maximum heating temperature of an engine oil is 120^{o}C. The maximum heat baring capacity of Turbidity sensor is 150^{o}C. A pH sensor is used to sense the pH level of the engine oil. To find the Temperature of engine oil we have used a Temperature sensor. Figure 3 shows the image of the Temperature sensor. And a float sensor to check the level of the fuel in the vehicle.

IV. CIRCUIT BLOCK DIAGRAM

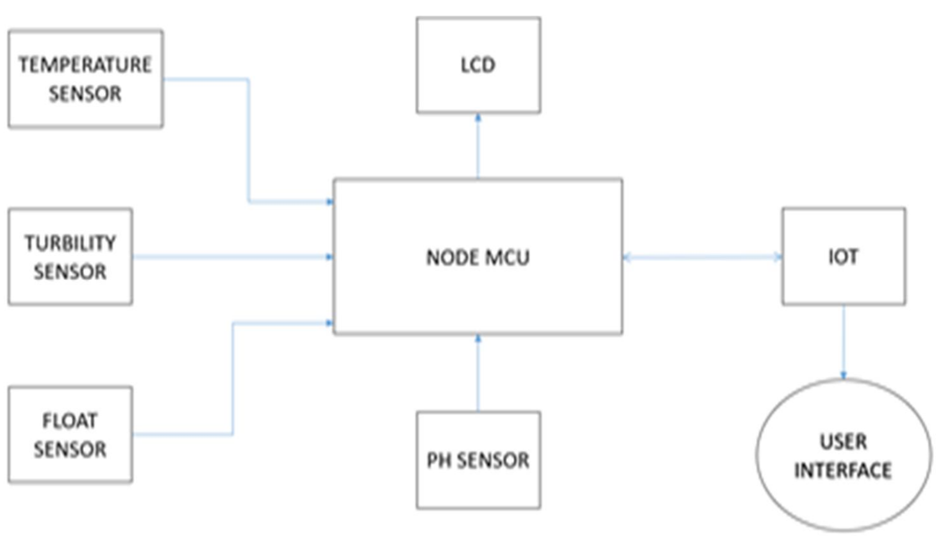

FIG 1 : Circuit Block Diagram

A. TSD-10 Turbidity Sensor

In the context of engine oil, turbidity, which is a measure of the cloudiness or haziness of a fluid caused by suspended particles, is not a common parameter of interest. Engine oil is expected to be clear, and any cloudiness would likely indicate contamination or the presence of foreign particles, which could be detrimental to the engine's performance. The Figure 2 shows the image of the Turbidity sensor.

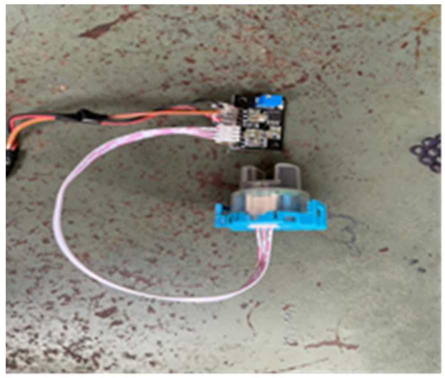

FIG 2 : TSD-10 Turbidity sensor

B. PH Sensor

A pH sensor for engine oil monitoring is a specialized device designed to measure the acidity or alkalinity of engine oil. It operates on the principle that the pH level, which represents the concentration of hydrogen ions in a solution, can indicate the oil's chemical condition. In the context of engine oil monitoring, maintaining an optimal pH level is crucial for the lubrication system's effectiveness and the overall health of the engine. The Figure 3 shows the image of pH sensor.

FIG 3 : pH sensor

C. DS18B20 Temperature Sensor

A DS18B20 temperature sensor for engine oil monitoring is a specialized device designed to measure the temperature of the engine oil in an internal combustion engine. This sensor is a crucial component in automotive systems, providing real-time data on the temperature of the engine oil to ensure optimal operating conditions. The information gathered by the temperature sensor aids in preventing overheating, optimizing engine performance, and contributing to the overall longevity and efficiency of the engine. Figure 4 shows the image of the Temperature sensor.

FIG 4 : DS18B20 Temperature sensor

D. Float Sensor

A float sensor for fuel level monitoring is a device designed to measure and indicate the level of fuel in a tank. It typically consists of a buoyant float connected to a mechanical arm. As the fuel level in the tank changes, the float rises or falls accordingly. The movement of the float is translated into electrical signals that can be interpreted to determine the current fuel level. Figure 5 shows the image of Float.

FIG 5 : Float sensor

E. LCD (Liquid Crystal Display)

This screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. Figure 6 shows the image of LCD.

FIG 6 : LCD (LIQUID CRYSTAL DISPLAY)

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F. Esp8266 Node Mcu Wifi Development Board

Setup ESP8266 Support:

When you've restarted Arduino IDE, select ‘Generic ESP8266 Module’ from the ‘Tools’ -> ‘Board:’ dropdown menu. Select 80 MHz as the CPU frequency (you can try 160 MHz overclock later. Select ‘115200’ baud upload speed is a good place to start - later on you can try higher speeds but 115200 is a good safe place to start. Go to your Windows ‘Device Manager’ to find out which Com Port ‘USB-Serial CH340’ is assigned to. Select the matching COM/serial port for your CH340 USB-Serial interface.

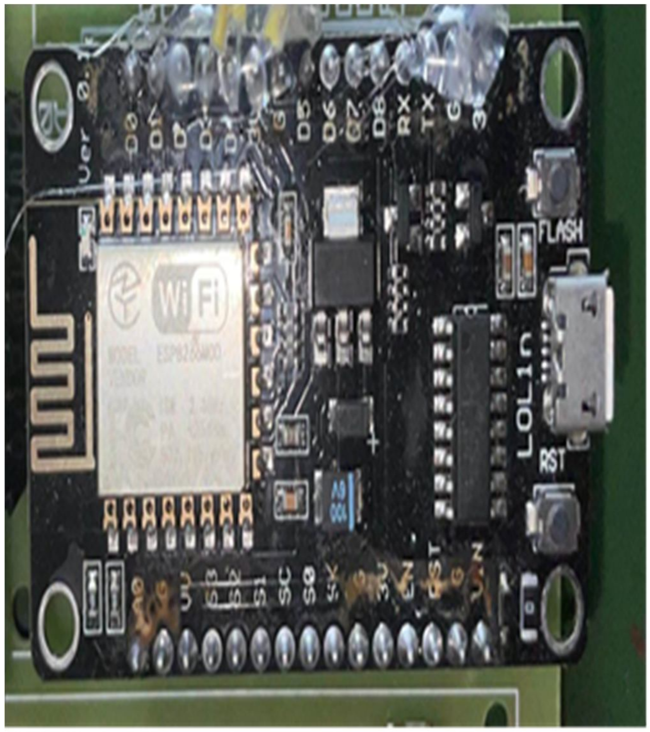

FIG 7 : ESP8266 Node MCU WiFi Development Board

V. INTEGRATION OF SENSORS WITH NODE MCU

Integrating sensors with a Node MCU in an engine monitoring system involves several steps to ensure accurate data collection and seamless communication with the monitoring platform. First, the selection of appropriate sensors is crucial, considering parameters such as oil level, temperature, pressure, and vibration. These sensors must be compatible with the NodeMCU and capable of providing accurate readings for the intended parameters. Once selected, the sensors are connected to the NodeMCU's GPIO pins, with attention to voltage compatibility and signal conditioning if needed.

The software development process entails writing firmware for the NodeMCU using suitable development environments like Arduino IDE or PlatformIO. This firmware includes code to read data from the sensors, process it using algorithms for calibration and filtering, and transmit it over Wi-Fi or other communication protocols. Implementing error handling and data validation mechanisms ensures the integrity of the transmitted data.

For data transmission, the NodeMCU is configured to establish a connection with the monitoring system, be it a cloud-based platform or a local server. Sensor data is transmitted periodically or based on predefined triggers using protocols like HTTP or MQTT, with security measures such as encryption and authentication in place to protect data transmission.

Testing and integration are crucial phases, involving thorough validation of sensor readings and data transmission in controlled environments. Once integrated into the engine monitoring system, comprehensive testing ensures accuracy, reliability, and performance under various operating conditions. Deployment follows, with careful installation and configuration to ensure compatibility with existing components and protocols.

Continuous monitoring and maintenance are essential post-deployment tasks. Regular monitoring of the system's performance, along with periodic maintenance such as sensor calibration and firmware updates, ensures optimal functionality. Remote monitoring and diagnostic capabilities facilitate timely identification and resolution of any issues that may arise, ensuring the reliability and effectiveness of the engine monitoring system.

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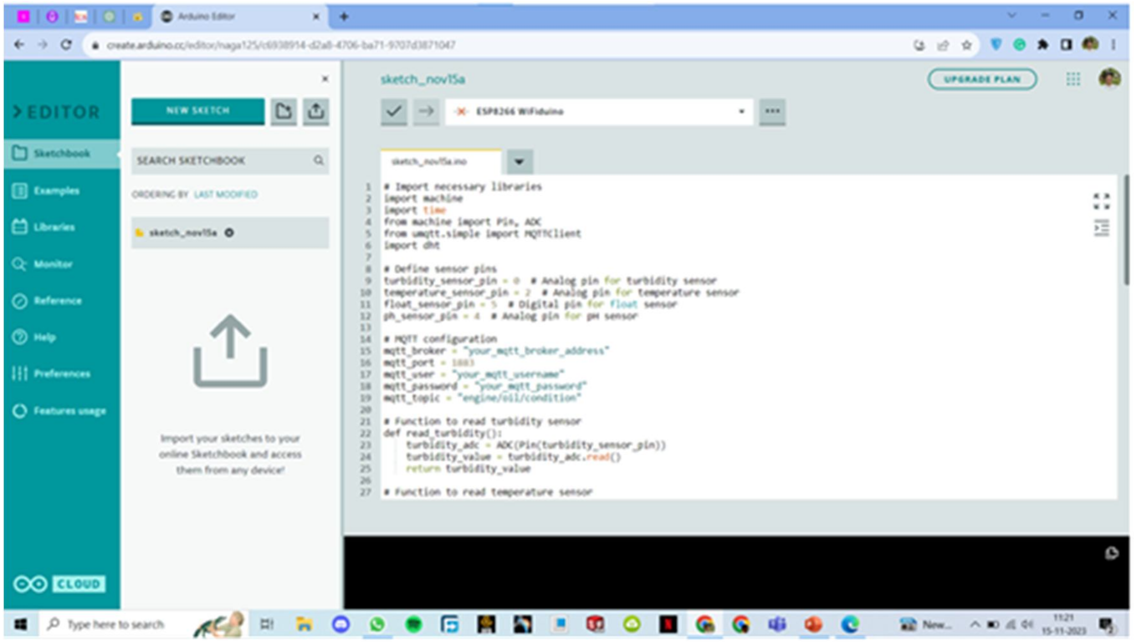

FIG 8 : INTEGRATION OF SENSORS WITH NODE MCU

VI. RESULTS AND DISCUSSION

The implementation of the Real-Time Engine Oil Monitoring and Fuel Level Monitoring system yielded promising outcomes, demonstrating its effectiveness in enhancing the performance, longevity, and safety of two-wheelers. The integration of precision sensors for real-time monitoring proved successful, providing accurate and reliable data on engine oil levels and fuel levels in various operational conditions.

The data acquisition system, coupled with a high-performance Central Processing Unit (CPU), effectively processed the real-time data from the sensors. The user-friendly interface, whether integrated into the vehicle's dashboard or accessible through a mobile application, provided riders with instantaneous insights into their vehicle's health. The system demonstrated its capability to communicate seamlessly with the onboard computer, accessing additional parameters for a comprehensive analysis.

The Real-Time Engine Oil Monitoring and Fuel Level Monitoring system represent a significant leap forward in the management and optimization of two-wheeler operations. By harnessing real-time data analysis and intelligent monitoring, the system addresses critical aspects of vehicle maintenance, offering riders proactive insights into engine oil and fuel levels.

The integration of such a system holds substantial significance in the context of urban mobility. Efficient two-wheelers contribute to reduced traffic congestion, lowered emissions, and enhanced overall transportation sustainability. The user-friendly interface empowers riders to make informed decisions about refueling and maintenance, fostering a culture of proactive vehicle care.

VII. CONCLUSION

The Ongoing evolution of the transportation landscape towards heightened efficiency, sustainability, and improved user experiences has led to a critical examination of the role played by two-wheelers, specifically motorcycles and scooters, in urban mobility. Acknowledging their pivotal position, this project has embarked on the development of a groundbreaking solution: Real-Time Engine Oil Monitoring and Fuel Level Monitoring. The emphasis on real-time data analysis and intelligent monitoring signifies a paradigm shift in the way we approach the management and optimization of two-wheeler operations. As we delve into the details of this innovative system, it becomes evident that its significance extends beyond mere technological advancement. The anticipated benefits, ranging from enhanced performance and longevity to elevated safety standards, underscore the potential for transformative change in the realm of urban transportation. Moreover, the ripple effect of these advancements is poised to contribute positively to the environment, aligning with the global push for sustainable practices in the transportation sector. In essence, this project serves as a testament to the capacity of technology to reshape and elevate our transportation experiences, ensuring that two-wheelers not only remain integral to urban mobility but also evolve as paragons of efficiency, safety, and environmental responsibility.

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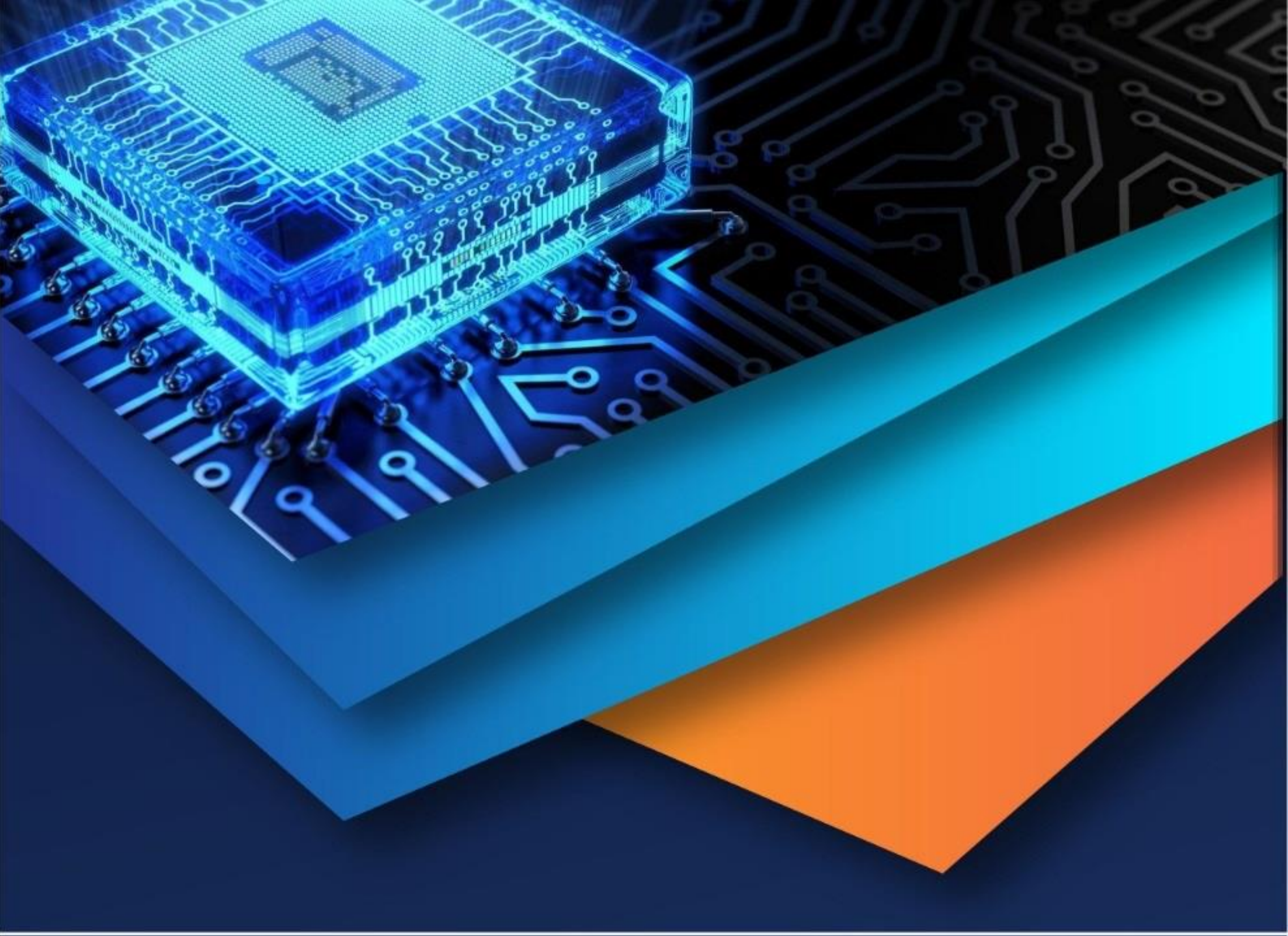

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