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Control Of Vehicle Pollution Through Internet Of Things (IOT)

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Abstract: ***Emissions that are released directly into the atmosphere from the tailpipes of vehicles are the primary source of vehicular pollution. With the increase in urbanization and industrialization and due to poor control on emissions, a great amount of particulate and toxic gases are produced. So, in our proposed system we use of spectrophotometer (spectrophotometry method) as a sensor to identify the toxic gas. Missions are measured during regular basis and informed to the user if above the permitted level and the failure of sensor. If user doesn't take any action within a week the alert is passed to the server of the pollution monitoring center through Internet of Things (IoT). The center decides the fine amount and intimates the user.***
Keywords: Toxic gases, Spectrophotometry, Monitoring unit, Internet of Things, Permitted level

I. INTRODUCTION

Nowadays, vehicle usage is very much higher. Most of the people are using gas fuel instead of petrol or diesel. This method is quite easy but on the other hand it is harmful also. Transportation can be responsible for more than 50% of carbon monoxide in the air. The air pollution may lead to Chronic Obstructive Pulmonary Disease (COPD) and escalates risk of cancer. The public health is affected due to pollution from cars and trucks can also be very high in the large metropolitan cities. One of the major reasons of air pollution is emission of polluting gases from vehicles which is responsible for 70% of the total air pollution. So, these types of vehicles required proper monitoring. So the amount of air pollution needs to be monitored and vehicles responsible for polluting should be identified. Internet of Things may become helpful in cities for monitoring air pollution from vehicles and also data related to the amount of pollution on different roads of a city can be gathered and analysed. Recent approaches in sensing technology, especially in the area of Wireless Sensor Networks (WSNs), it now empower environmental monitoring in real time at special and temporal scales [3]. This paper specially designed to operate the system using sensor network and gather the information about pollutant levels discharged by the vehicles. IoT is a new technology which draws the consideration for both academia and industry. This paper aims to modify an existing safety model employed in domestic field. The aim of this paper is designing a microcontroller based toxic gas detection , and if the gas has detected it automatically alert the owner and also the vehicle door will be automatically opened then it transmits the warning message to the authorized user.

II. DESIGN METHODOLOGY

A. Spectrophotometry

Spectrophotometry is a method to measure how much a chemical substance absorbs light by measuring the intensity of light as a beam of light passes through sample solution. A spectrophotometer is an instrument that measures the amount of photons (the intensity of light) absorbed after it passes through sample solution. With the spectrophotometer, the amount of a known chemical substance (concentrations) can also be determined by measuring the intensity of light detected. Depending on the range of wavelength of light source, it can be classified into two different types: 1. UV-visible spectrophotometer: uses light over the ultraviolet range (185 - 400 nm) and visible range (400 - 700 nm) of electromagnetic radiation spectrum. 2. IR spectrophotometer: uses light over the infrared range (700 - 15000 nm) of electromagnetic radiation spectrum. In visible spectrophotometry, the absorption or the transmission of a certain substance can be determined by the observed color. For instance, a solution sample that absorbs light over all visible ranges (i.e., transmits none of visible wavelengths) appears black in theory. On the other hand, if all visible wavelengths are transmitted (i.e., absorbs nothing), the solution sample appears white. If a solution sample absorbs red light (~700 nm), it appears green because green is the complementary color of red. Visible spectrophotometers, in practice, use a prism to narrow down a certain range of wavelength (to filter out other wavelengths) so that the particular beam of light is passed through a solution sample.

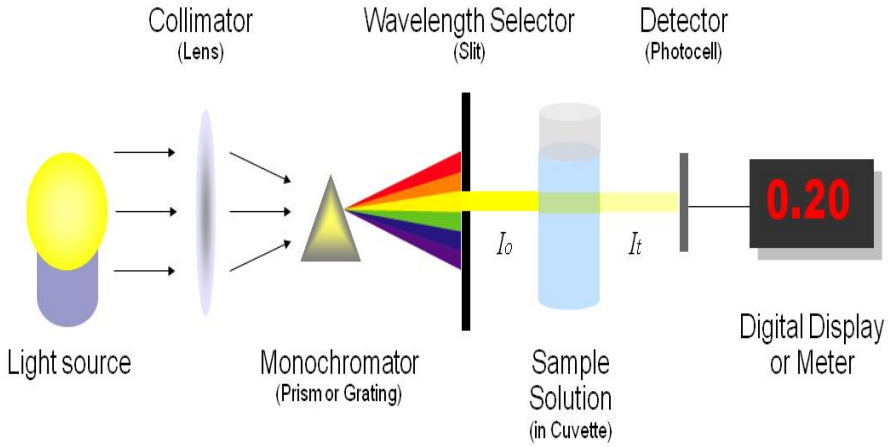

Fig 1: basic structure of spectrophotometers

You need a spectrometer to produce a variety of wavelengths because different compounds absorb best at different wavelengths. For example, p-nitro phenol (acid form) has the maximum absorbance at approximately 320 nm and p-nitrophenolate (basic form) absorb best at 400nm, as shown in Figure2.

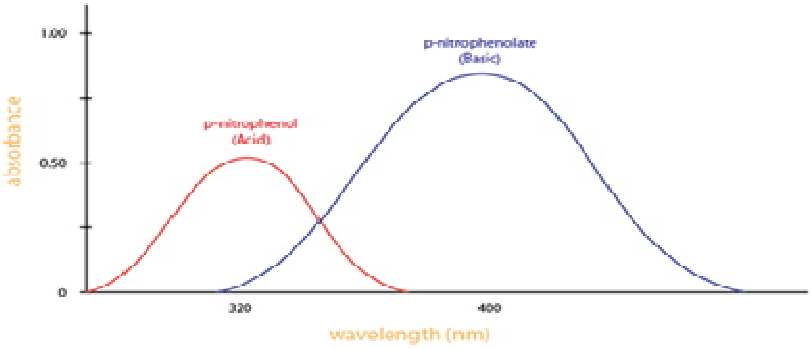

Fig 2: Absorbance of two different compounds

B. IOT System

IoT systems allow users to achieve deeper automation, analysis, and integration within a system. They improve the reach of these areas and their accuracy. IoT utilizes existing and emerging technology for sensing, networking, and robotics. IoT exploits recent advances in software, falling hardware prices, and modern attitudes towards technology. Its new and advanced elements bring major changes in the delivery of products, goods, and services; and the social, economic, and political impact of those changes.

III. PROPOSED SYSTEM

Proposed system is based on two units. It has two implementation parts: First we monitor the emission level using spectrophotometer. This is called as vehicle unit. Second we maintain the database for making fine amount and future purpose. This is called as server unit. To reduce the complexity of multiple units, these two methods are used.

A. Vehicle Unit

The vehicle unit consists of sensors, ADC, microcontroller and Wi-Fi module. In this unit the sensor is used to collect the data of pollution due to the vehicle. This data is compared with spectrometer values. This data fed to ADC analog to digital converter which converts all analog data to digital data. This digital data afterwards fed to microcontroller. Microcontroller in each vehicle contains specific identity number. In this unit the Wi-Fi module receives data from vehicle unit which consist of information regarding pollution and identity number of vehicle. This data is fed to the server unit.

B. Server Unit

Server side unit consist of database at server. This database consists of data regarding pollution standards and vehicle owner identity. The data base is stored with the help of MY SQL. Server will compare original standard with data from vehicle. If pollution overcomes predefined value a message will generate in the favor of vehicle owner to convey him his vehicle not working properly.

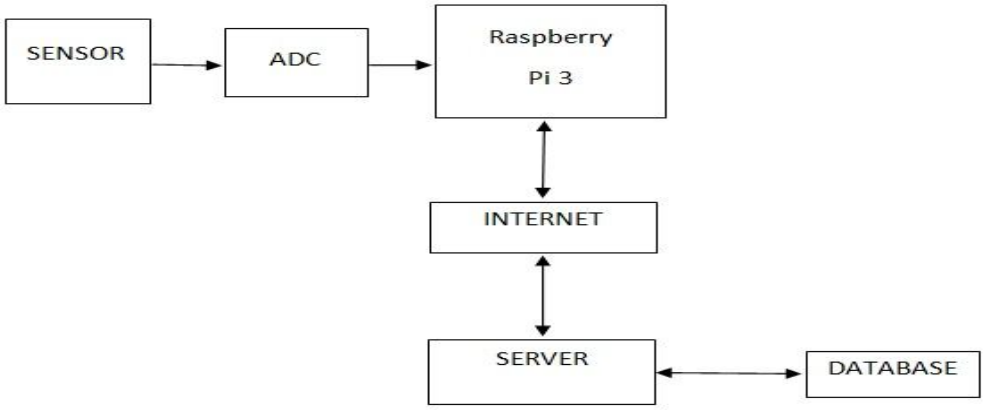

Fig 3: proposed system

IV. HARDWARE IMPLEMENTATION

A. Sensors

Gas sensors are available in wide specifications depending on the sensitivity levels, type of gas to be sensed, physical dimensions and numerous other factors. When a gas interacts with this sensor, it is first ionized into its constituents and is then adsorbed by the sensing element. This adsorption creates a potential difference on the element which is conveyed to the processor unit through output pins in form of current. Spectrophotometer is a method to measure how much a chemical substance absorbs light by measuring the intensity of light as a beam of light passes through sample solution. The basic principle is that each compound absorbs or transmits light over a certain range of wavelength. This measurement can also be used to measure the amount of a known chemical substance. Spectrophotometer is one of the most useful methods of quantitative analysis in various fields such as chemistry, physics, biochemistry, material and chemical engineering and clinical applications

B. Carbon Monoxide Sensor

Gas sensors are available in wide specifications depending on the sensitivity levels, type of gas to be sensed, physical dimensions and numerous other factors. When a gas interacts with this sensor, it is first ionized into its constituents and is then adsorbed by the sensing element. This adsorption creates a potential difference on the element which is conveyed to the processor unit through output pins in form of current. Spectrophotometer is a method to measure how much a chemical substance absorbs light by measuring the intensity of light as a beam of light passes through sample solution. The basic principle is that each compound absorbs or transmits light over a certain range of wavelength. This measurement can also be used to measure the amount of a known chemical substance. Spectrophotometer is one of the most useful methods of quantitative analysis in various fields such as chemistry, physics, biochemistry, material and chemical engineering and clinical applications.

C. NOx Sensor

The Grove - Gas Sensor (MQ2) module is useful for gas leakage detection (in home and industry). It is suitable for detecting H2, LPG, CH4, CO, Alcohol, Smoke or Propane. Due to its high sensitivity and fast response time, measurement can be taken as soon as possible. The sensitivity of the sensor can be adjusted by potentiometer.

D. Spectrophotometer

Spectrophotometer is a method to measure how much a chemical substance absorbs light by measuring the intensity of light as a beam of light passes through sample solution. The basic principle is that each compound absorbs or transmits light over a certain

range of wavelength. This measurement can also be used to measure the amount of a known chemical substance. Spectrophotometer is one of the most useful methods of quantitative analysis in various fields such as chemistry, physics, biochemistry, material and chemical engineering and clinical applications.

V. RASPBERRY PI 3

The Raspberry Pi is a series of credit card–sized single-board computers developed in the United Kingdom by the Raspberry Pi Foundation with the intention of promoting the teaching of basic computer science in schools and developing countries. The original Raspberry Pi and Raspberry Pi 3 are manufactured in several board configurations through licensed manufacturing agreements with Newark element14 (Premier Farnell), RS Components and Egoman. The hardware is the same across all manufacturers.

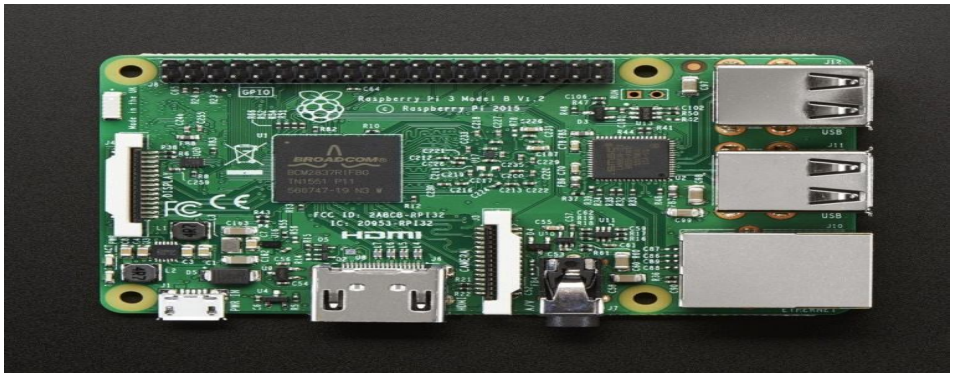

Fig 4: Raspberry pi 3

VI. SOFTWARE IMPLEMENTATION

A. *CSS Software*

Cascading Style Sheets are arguably one of the greatest things that happened to the web just over a decade ago. As you were writing your HTML in the previous tutorial, you might have thought that building a web page was lacking something. CSS is not only beautiful and stylish, but it is also very efficient. Cascading Style Sheets reside on the client side, which means the user can, with the correct knowledge, see all of your CSS files. Style Sheets were invented because the internet was plum boring due to the creators being scientists who were primarily interested in using the internet as a medium for communication.

B. *MySQL*

Databases are a key component of most Web-based business, storing everything from basic user credentials (e.g., username and password) to complex purchase histories. There are several facets of database systems that are courses in their own right and are beyond the scope of this document – for example, database implementation, and database normalization (i.e., designing tables to minimize the duplication of data). The typical setup for a database management system (DBMS) is based on a database server, which handles the storage of data and provides the interface between the users (i.e., programmers) and the data itself.

. VII. RESULTS

IoT based pollution monitoring system is developed and the performance of the developed system is verified successfully for various vehicles. The monitoring system displays the pollutants levels of the vehicle. Fig 5 shows the hardware kit of the paper with sensors.

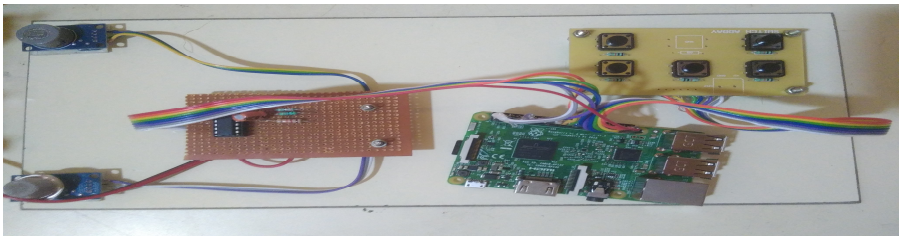

Fig 5.Hardware kit

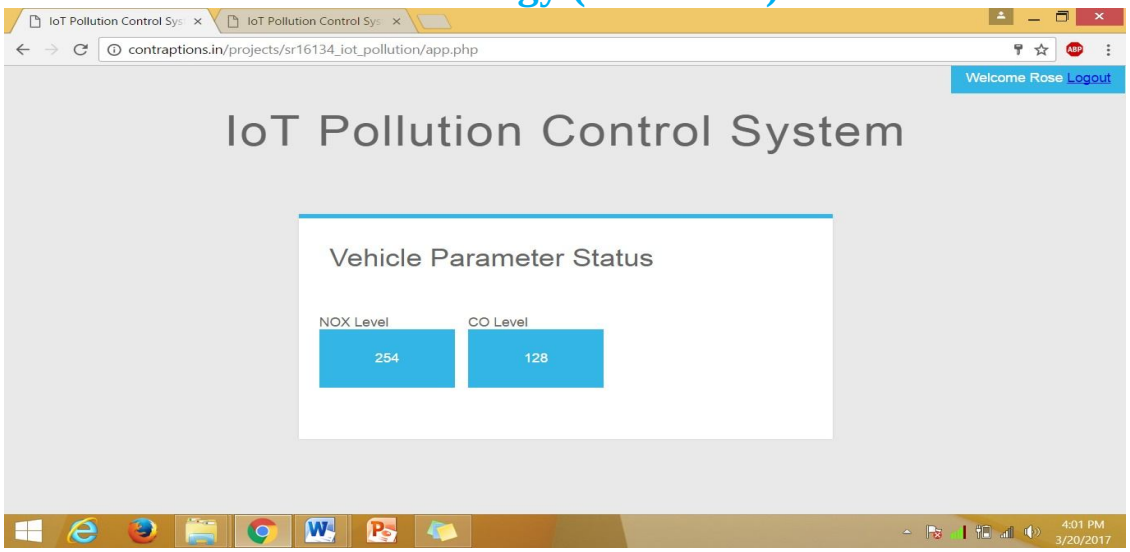

Fig 6.user login page

The controller sends the details of the vehicle and the pollutant values to server for monitoring the pollution levels of vehicle. The Server displays the pollutant levels. Fig 6 shows the user login page of the vehicle owner. It displays the pollution level of a vehicle.

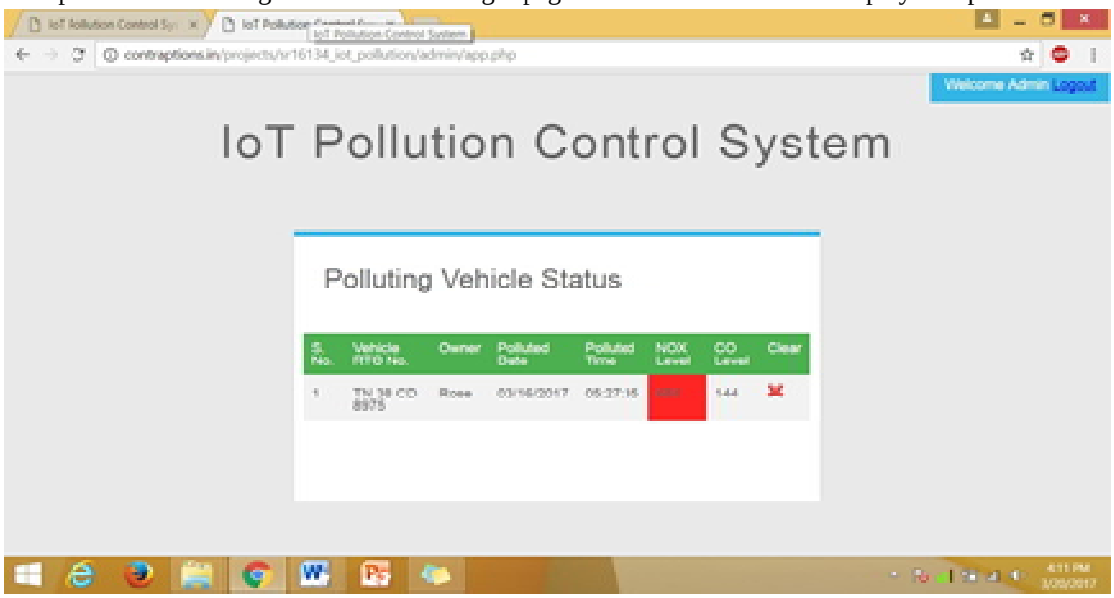

Fig 7.admin page with exceeded NOx level

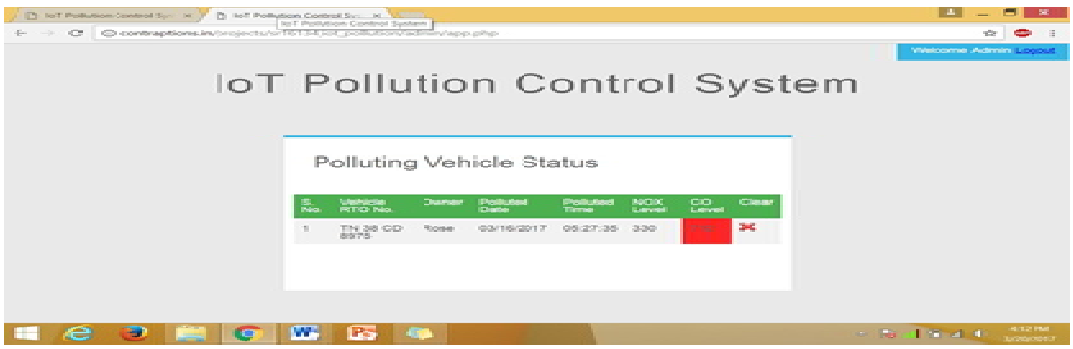

Fig 8.admin page with exceeded CO level

VIII. CONCLUSION

The concept of detecting the level of Pollution and indicating it to the driver is implemented. This system is cost effective solution for vehicle emission problem. From analysis discussion we concluded that co exhaust can be reduced by using this system. Security at server side is maintained as only authorized person can only know the information of pollution through vehicles. Hence this system will be highly beneficial in curbing this problem.

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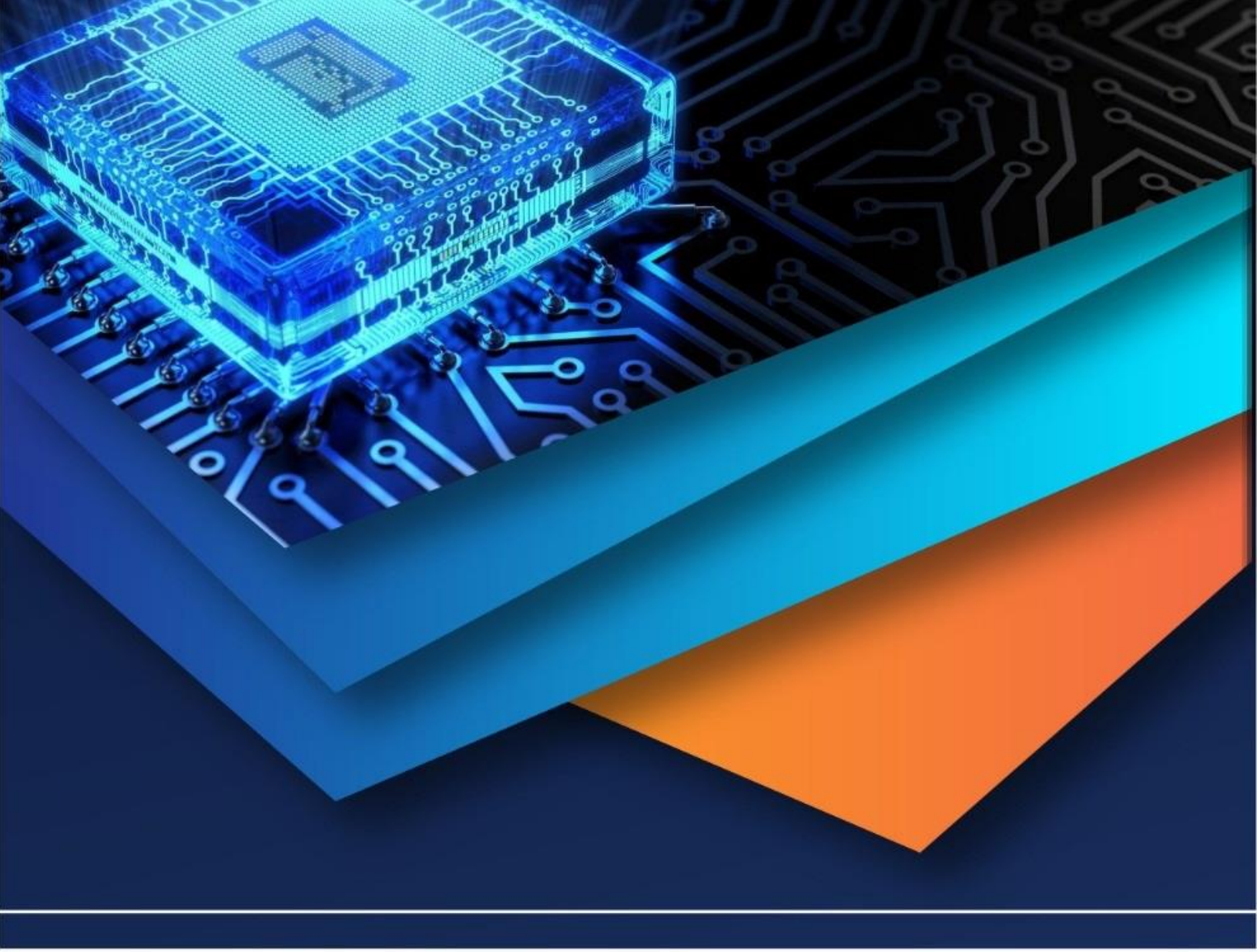

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