iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** IX **Month of publication:** September 2019

DOI: http://doi.org/10.22214/ijraset.2019.9136

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 7 Issue IX, Sep 2019- Available at www.ijraset.com

Automated Digital Petrol Pump using Arduino ATmega2560

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Abstract: ***The security challenges being encountered in many places today by means of controlling access in order to secure the premises. Nowadays petrol stations are operated manually we required more man power & it is time consuming process. So we have proposed a system in order to make easier, reliable & secure system. The main aim of this paper is to present an Automatic Fuel Dispensing System based on RFID & GSM Technology. RFID reader is installed at the bunk. Every customer is provided by a unique RFID Cards .On swapping the RFID Cards the authentication of passwords & available balance amount of the user is done. If both are fine, then the fuel filling process gets initiated automatically according to the customer entered amount. Passive RFID Tags can be recharged through online facility which is provided to every customer, through his smart phone by using GSM Technology. The deduced amount & remaining balance amount of every RFID Cards is send to the user smart phones using GSM Technology, even the deduced amount information is send to the web server using Wi-Fi Technology.***
Keywords: Arduinomega2560 microcontroller, RFID Reader, Passive Tags, GSM Module, Fuel Dispensing System, LCD Display, Keypad, Level sensor, Gas sensor, Fire sensor, Wi-Fi Module.

I. INTRODUCTION

The 21st century is commonly known as the internet of age because of the increasing use of internet in day to day activities. The increase in the number of vehicles in India recently has led to the congestion & long traffic jams in almost all cities of India. The Petroleum products are one of the valuable & rare creations of the nature. The proper usage & distribution of the petrol is an important task to the peoples. Nowadays, most of the fuel station are manually operated which requires two persons i.e one to fill the petrol & other one to collect the cash. For placing the petrol stations in a rural area, is so difficult in order to provide the good facilities according to the customer's needs. The conventional fuel stations has caused many accumulated complications factors, among which one such factor is that the vehicle driver has to pay more money than the amount of dispensed fuel due to lack of small money change with station operator. Older petrol pump systems were not reliable enough. For example, in system with paper recharges, there may be a use of false coupons that are very similar to the original one. Again, we do not have the actual calculations, or the petrol amount that is dispensed on daily or monthly basis neither how many paper recharge are circulating. Therefore, the aim of this project is to provide validation to the customer & automatically regulate the start & stop of the tank value in accordance with the requested user's amount. The most common problem experienced by the customer's is wasting time in long queues. Therefore it is important to address the most common problem first. This paper describes a model that addresses these issues. In the proposed system it is the microcontroller based project which controls the whole assembly of automation of petrol bunk management i.e smart card, relay, and motor. It also provided the facility of onsite recharge on the completion of transaction money is with drawls from RFID cards & the balance is shown again on the LCD Display. When the balance in customer account is low, the process will not be carried out & message will be displayed as "Low Balance". All the details of the user's i.e amount of petrol dispensed are stored in the database when the fuel is dispensed.

II. LITERATURE SURVEY

Sylvanius.F.Browser et.at., Proposed the "Fuel Filling Station", he applied an idea to a kerosene pump attached to a wooden barrel. The storage barrel, the plunger, & a hand lever unit were self contained & this pumping unit was a huge success & become a "Fuel Filling Station" [3]. Wavekar.Asrar.A et.al., proposed a "RFID Based Automated Petrol Pump" which is capable of automatically deducing the cost of petrol dispensed from user RFID card. This system uses AT89C52 microcontroller and it uses a unique dispensing system which operates with prepaid card using RFID technology. But the disadvantage of this system is that it does not have the recharge facility & detail information of customer for the future use [2]. Rakesh et.al., proposed system utilizes the RFID Technology to provide customer unique ID. Arduino microcontroller is the heart of the projects. The proposed system provides the automatic deduction of amount from the customer's prepaid account. But the disadvantage of these system is that there is no security provided for the RFID prepaid cards [1].

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III. PROPOSED DESIGN METHODOLOGY

The proposed system consists of Arduino mega2560 microcontroller, RFID Reader (EM-18), Passive Tags, 16*2 LCD Display, Wi-Fi Module, GSM Module, Fuel Dispensing system, level sensor, Gas sensor, Fire sensor, keypad, and buzzer. The block diagram of an RFID based security access control system with GSM technology is shown in fig 1. The customer who wants to use the unmanned petrol pump will have need to register his/herself to corresponding petroleum industry with an initial amount to recharge their balance. The RFID reader (EM-18 Module) is installed at the bunk , when its gets powered & the passive tags(transponder) is brought within the reading range of the reader, the reader scans the data present in the tag with the help of its antenna & compares it with the data present in the microcontroller. So it checks the number whether it is an authorized card or not, if it is authorized the corresponding information is displayed on LCD display, else invalid card is displayed on the LCD display & the buzzer gets ON.

On swapping the RFID card, the authentication of password & available balance amount of user checking is done. If the balance is low the automatic fuel filling process does not start & LCD displayed “LOW Balance” & buzzer get ON. If both are fine, the user has to enter the amount of petrol to be dispensed with the help of keypad. The electrical pump is turned ON according to the entered amount fills the tank & automatically turns OFF. The corresponding amount is calculated & deducted from his RFID passive cards. A message of amount of fuel obtained by the user, amount deducted from the customer’s account will be sent to the register mobile number using GSM technology. These system provides the online recharge facility which can be easily access by the user smart phone, as well as user can recharge through keypad which is install at the petrol station. The system uses the centralized database to allow fuel station to share the same amount of data about vehicles & related balance i.e the user information will be added to filling station owner’s database. Additional features of the system is to provide the information regarding the fuel level to the owner i.e to sense the fuel level available in the tank or not, if low fuel level is detected the alert message is send to the owner cell phone. Also added to that our system Gas sensor & fire sensor is used, if the any gas & fire is deducted the alert message is send to owners cell phone. In these ways we have secured the system.

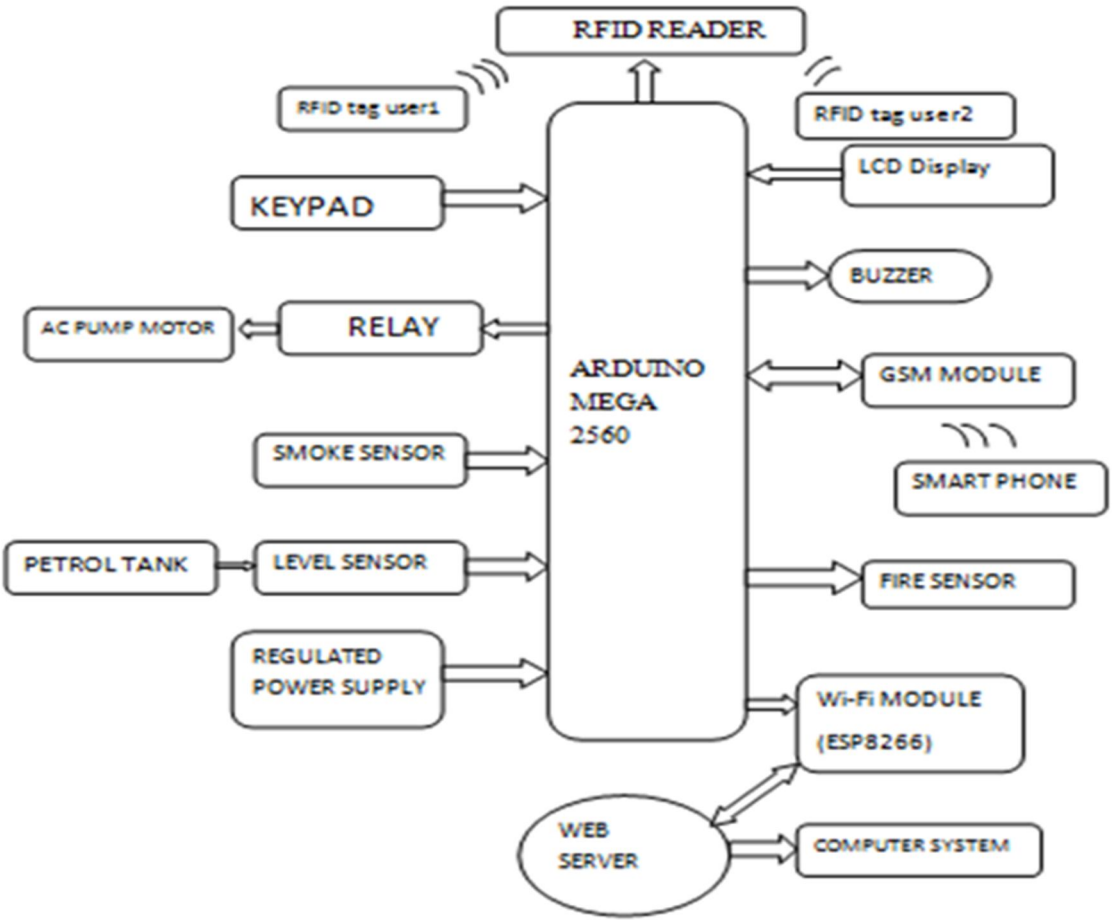

Fig.1 Block Diagram of Proposed system

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IV. HARDWARE IMPLEMENTATION

A. *Power supply:* This model requires both AC & DC supply, the DC is used for the Arduino & AC supply is used for submersible pump. The requirement is 12V, & AC is 230V. The model uses a step–down transformer, Bridge rectifier circuit & filter to convert AC to DC, so that required power is obtained.

B. *ArduinoMega2560:* The arduinomega2560 is widely used to controlled board with ATmega2560 chip microcontroller on board with 54- digital I/O pins, 16- analog pins & UART operates at 5V supply with many more features.

C. *GSM:* Global system for mobile communication is one of the most popular standards for mobile technology system. It is one of the wireless networks which have low power & low cost communication devices.

D. *RFID Reader & Tags: RFID* (Radio Frequency Identification) is a wireless technology based on the principle of magnetic Induction that uses radio signals in order to track the objects, identify & capture automatically. The EM-18 RFID Reader works at 125 KHz of frequency. The passive RFID Tags are most commonly used as they do not require any external power source. Tag consists of memory to store data & the transponder which sends feedback signals back to the reader.

E. *LCD (Liquid crystal display):* In our proposed system 16*2 LCD is a display unit. The material used in LCD combines the properties of both liquids & crystal. It has two registers namely command register & data register.

F. *Keypad:* 4*4 keypad is used in our model which consists of 4 rows & 4 columns. These are used to take input from the user, this is used for the application which requires more number of keys & easy to interface to any microcontroller.

G. *Node MCU (Wi-Fi Module):* It is used to provide the internet connection. It consists of ESP-8266 Wi-Fi networking solution & also capable of running self constrained applications.

H. *Buzzer:* The buzzer is an output device when an unauthorized user wants to access the RFID cards buzzer beeps the sound.

I. *AC Motor:* It is a submersible motor pump can lift water up to 0.7meters & it is easy to install & handle. It consumes low electricity & it is compact in size.

V. EXPERIMENTAL SETUP & RESULTS

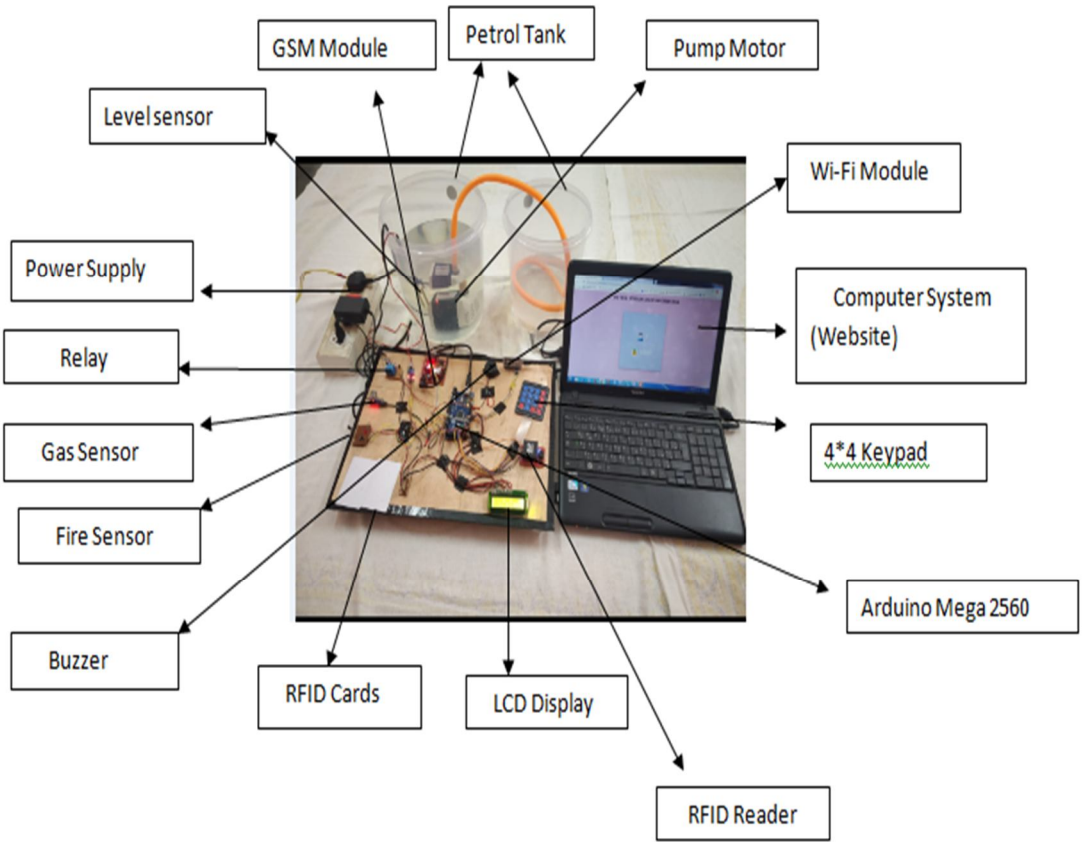

Fig. 2 Experimental Setup of the project

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Fig.3 Welcome Message

Fig .4 Swipe the RFID Card

Fig.5 Enter Password

Fig.6 Invalid RFID Card

Fig.7 Low Level of Petrol

Fig .8 Controller Fetching User's Information

Fig .9 Wrong Password

Fig.10: Select Option

Fig.11 Enter Amount

Fig.12 Petrol Filling Process

Fig.13 User Available Amount

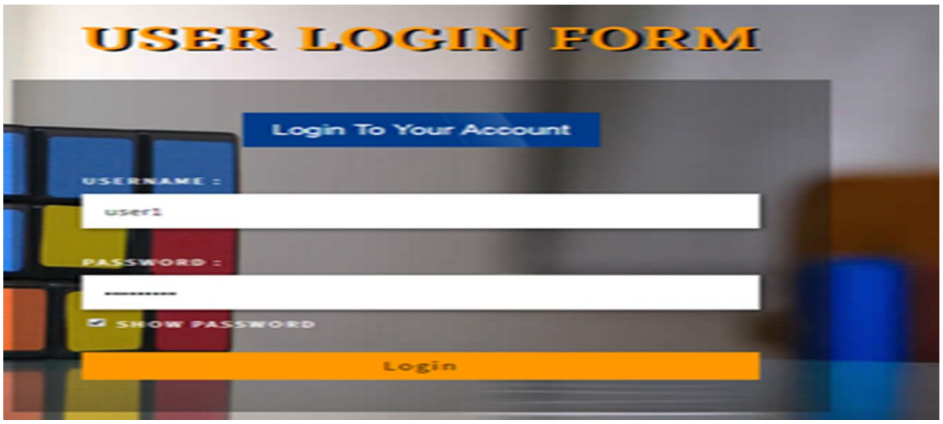

Fig.14 Login Webpage

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Fig.15 Low Balance

Fig.16 Enter Amount through Keypad

Fig.17 Recharge Done Displayed on LCD

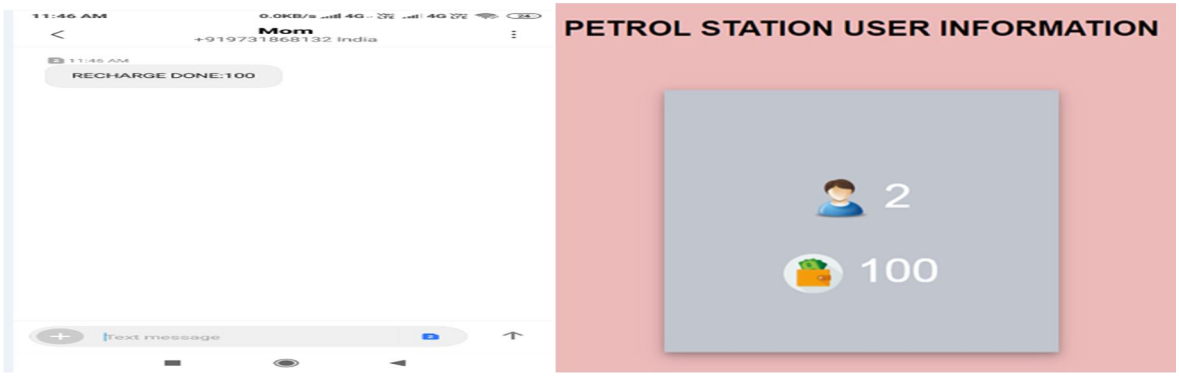

Fig.18 Updating For Recharge Amount

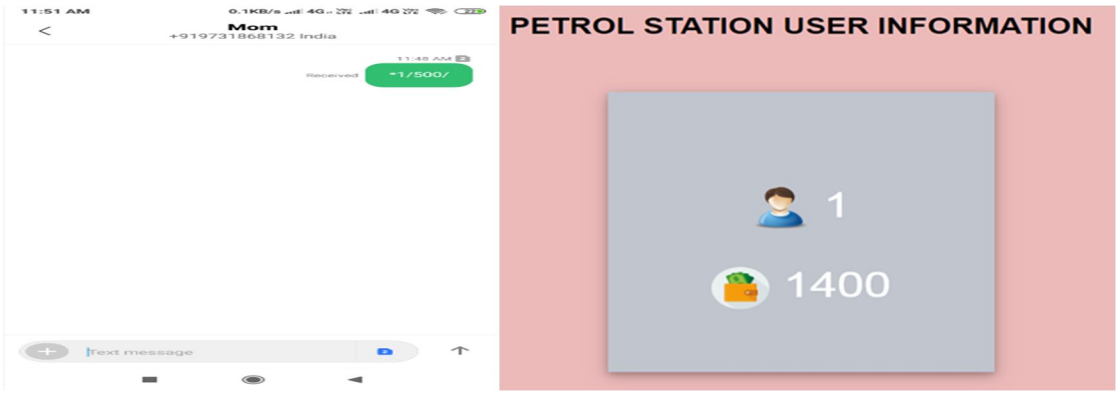

Fig.19 Recharge Process Is Done Through the User Mobile Phone

Fig.20 Low Level Of Petrol

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Fig.21 Smoke Detection Alert

Fig.22 Fire Detection Alert

VI. RESULTS

It is evident that the usage of this system is to reduce the man power & time. The proposed system provides the RFID & GSM technology which makes the system secure as it gives the unique identification number & online recharge facility to the customer respectively. LCD Display is used for displaying the pin number and results. The amount & pin number is being typed through keypad. The system accepts only authorized passive RFID cards. In addition to this system, Gas & Fire is deducted at the petrol bunk by using different sensors alert messages is send to the owner's cell phone through which he can provide safety measures & safe thousand of life.

VII. CONCLUSION

RFID & GSM System is a versatile technology. This system used in many application & real time application. The proposed system is a smart approach of moderning the current automatic fuel dispensing from the petrol pump. The system can connects to all the petrol station of different companies on a signal web server & this web server access is protected by a password & this password is only known to the petrol companies. The RFID system dispenses the accurate amount of fuel which reduces the misuse of fuel & it also reduces the man power . Hence the proposed system is lot more automotive compared to the present fuel dispensing system & is able to provide the best customer service.

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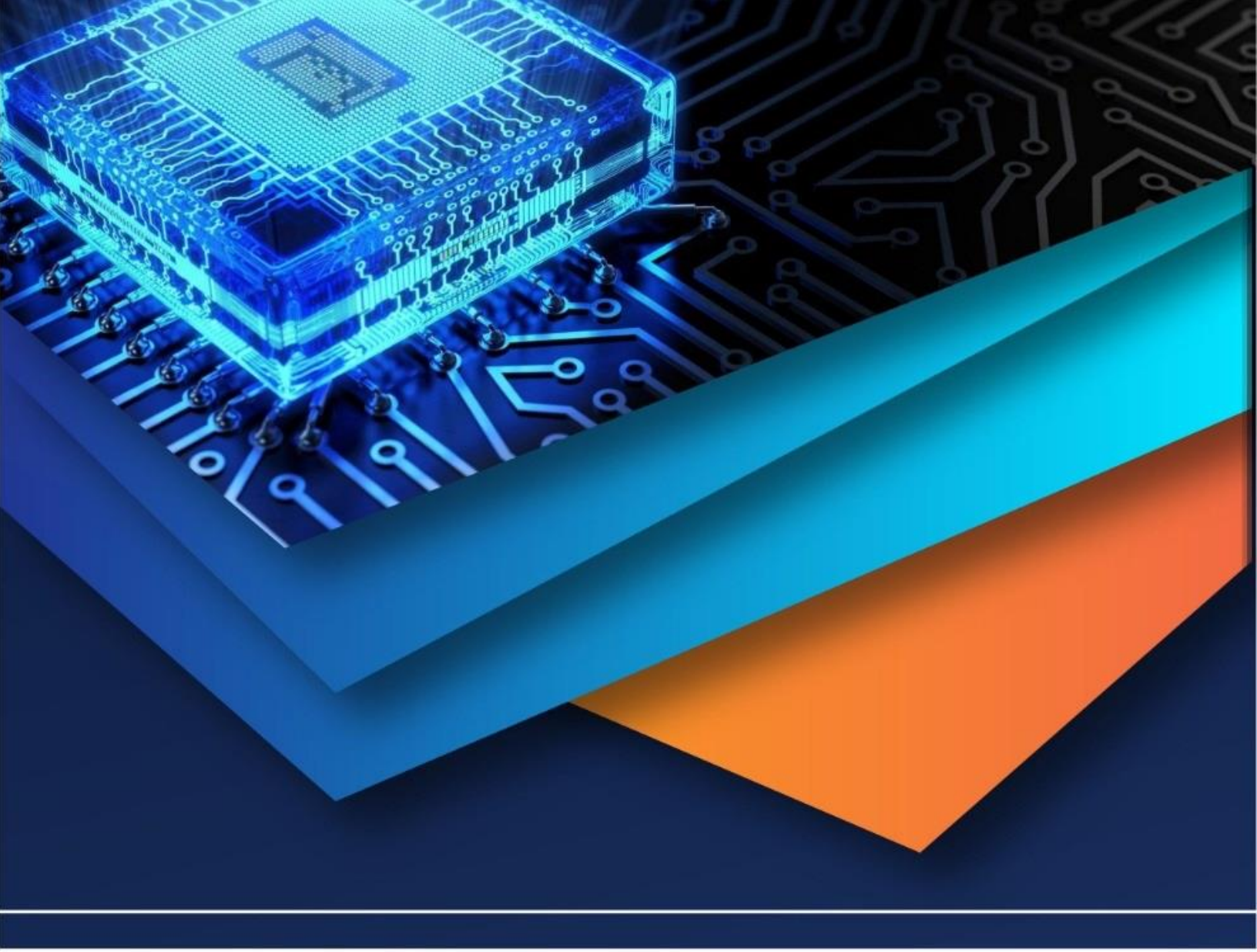

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