iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** VII **Month of publication:** July 2022

DOI: https://doi.org/10.22214/ijraset.2022.45125

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue VII July 2022- Available at www.ijraset.com

Any Time Medicine Vending Machine

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***Abstract:** This paper describes the design of any time medicine vending machine as a health device for the purpose of person who in need of medicines and its assistance. This device mainly consists of a card reader and the dispenser which comprises the automatic medicine vending machine through the dispenser as per the doctor's e-prescription updated into smart card. This vending machine is controlled by the Arduino board which is a single board computer and it can be aspect from online portal for the need person to check his e-prescription and the doctor to generate or update the prescription. When the patient swipes his smart card into the card reader, this device dispenses out the prescribed medicine for the need person only when the user credentials of the patient is validated from the e-prescription. The online portal is made on a telegram and connected to the same user credentials, and even though the patient can view his details and the prescription by logging in with are credentials into the same web page.*

***Keywords:** Card Reader, Smart Card, E-Prescription, User Credentials, Webpage, Health security.*

I. INTRODUCTION

According to the recent years, we can see increase in many diseases which is spreading with the people by communicably and also non-communicably. Even the people are getting more aware about their health, hence we can see the noticeable growth in health and the industry under healthcare. So, for the enhancement of this growth even the digitized services and the technology are playing and important role. Also, this helps in improving the data for getting the excepted outcomes of the industry especially in the rural areas. Some companies are very much fast in these technologies even which is cost effective and digital solutions for improving the healthcare and even to bring it to the top. But in many places are still having backward infrastructure when it comes to healthcare and medical professionals. Also, they give more preference to developed areas rather than rural areas. From many health organization surveys estimated that across 37 countries,6% of the population were pushed into extreme poverty because of paying more for health services. India stands in the second position with respect to population though the health infrastructure is not efficient. In the emergency, mainly in rural areas patient will not get proper healthcare and required medicines so that they should face the difficulties in medical requirements and diagnosis.

A study on 'Consumer, Perceptions, Availability, Role, Services, Provided, Medicines and Expectations of Pharmacists in India' by D. B. Anantha Narayana et al done in 2011 showed that in India showed that only 4% of people who took part in the survey did not visited the medicals shops and 12% did not have medical shops in their areas. In India, there is a increase in start-ups to provide better healthcare and medical facilities at lower costs. This paper describes the prototype of ATMVM which provides quick supply of prescribed medicines in case emergencies. ATMVM consists of automatic medicine vending machine which is operated using a monitor. The user must enter the given prescription ID, if user credentials is validated, then the user will be allowed to select the prescribe medicines and collect those medicines through dispenser. Even the doctor will be provided with the online portal, so that he will generate the prescription for the patient. After this process the patient will get to know his prescription ID by accessing through message.

In present situation, medical transaction is done online, the supply of drugs can be tracked easily. The transaction would be more secure and all sort of malpractices will come to an end. A pulse sensor has been attached to the vending machine that can sends the heart rate to the doctor directly. According to reports, 27% of deaths occur due to lack of medicines. ATMVM device provide 24X7 medical facilities, so that any person who is in need of medicines can go to ATM and can collect the medicine through dispenser.

II. LITERATURE REVIEW AND COMPARATIVE STUDY

The amount of research and development in this field has increased significantly as a result of people's growing awareness of and care for their health, and it is anticipated that this growth will continue with more support from public and private institutions and businesses. This section has reviewed some of the previous research on healthcare and medication availability that served as inspiration for the ATMVM device's design and technique.

[1]For both caretakers and Alzheimer's patients, a prototype medication dispenser was created. By scanning the medications with bar code scanners, careers can input the medications into the device or restock the dispensers. The GUI's touch screen must be touched by the patients in order to deliver the medication. If a patient doesn't take their medication within the allotted time, the caregiver is notified by SMS. [2] addressed how to build a smart drug dispenser that is highly scalable and remotely managed. The dispenser features a real-time clock to monitor the patient's medications, and the predetermined medication is administered from the medicine tray when the patient hits a button at the appropriate moment. The quantity of medications dispersed out has been monitored using infrared sensors. Additionally, they have employed LAN to occasionally deliver patient-free medication status updates. [3] have written about the development of mobile-based prescriptions that eliminate the requirement for elderly or ill patients to visit their doctor in order to acquire written prescriptions. Each medication package has an NFC tag attached, and they have been communicating with these tags using mobile phones with NFC (Near Field Communication) capabilities.

In this manner, the patient can ask the doctor for a mobile prescription; the doctor then uses a mobile application to see the patient's requests and prescribe the medications; and finally, at the pharmacy, this prescription is wirelessly sent to the store's computer and an NFD reader is used to obtain the medications. [4] Described the creation of a prototype for a smart medical refrigerator that monitors a patient's medicine intake and notifies a healthcare professional, family member, or doctor through a regular telephone line if the patient forgets to take their medication at the scheduled time. [5] Design and construction of a prototype for a low-cost automated medicine dispenser that can count medications and deliver them into vials for use by pharmacists. They have employed infrared sensors to count the amount of drugs dispensed with an accuracy of 90% and standard size servos to dispense the medications. [6] Describes the creation of an autonomous Arduino-controlled gadget that enables a caregiver to customize the patient's tablet medication distribution. [7] Explains how RFID (Radio Frequency Identification) and IoT are used to regulate medication (Internet of Things).

Normal medication distribution operations have been coupled with a website and a GUI in the ATMVM gadget, adding originality to our concept. [1] and [5] created a medication dispenser, but they left out a doctor communication or online prescription system. However, [3] have detailed a mobile-based prescription system that sends the patient to the pharmacy to pick up the medication.

III. TECHNICAL BACKGROUND AND PRELIMINARIES

We have outlined a few technical underpinnings in this section to ensure that our proposed technique is better understood.

A. ARDUINO Megha

A microcontroller board based on the ATmega2560 is called the Arduino Mega 2560. It contains a 16 MHz crystal oscillator, 54 digital input/output pins, 16 analogue inputs, 4 UARTs (hardware serial ports), a USB connector, a power jack, an ICSP header, and a reset button.

General pin functions (Figure 4.5.1):

1) *LED:* The inside LED is powered by digital pin 13. The LED is on when the pin has a HIGH value; it is off when the pin has a LOW value.
2) *VIN:* The Arduino board's input voltage when powered by an external source (as opposed to 5 volts from the USB connection or other regulated power source). This pin can be used to access voltage that has been supplied via the power jack or to feed voltage to it.
3) *5V:* The regulator on the board produces a controlled 5V through this pin. The board's VIN pin, the USB connection (5V), or the DC power jack (7 to 20V) may all be used to supply power to it (7- 20V).
4) Ground pins, or GND.

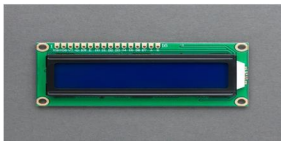
Arduino UNO

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue VII July 2022- Available at www.ijraset.com

B. LCD

A flat-panel display or other electronically manipulated optical device that makes advantage of liquid crystals' ability to modify light is known as a liquid-crystal display (LCD). Liquid crystals don't emit light directly; instead, they create pictures in either colour or monochrome utilising a backlight or reflector. There are LCDs that can show random graphics (like those on a general-purpose computer display) or fixed images with little information that can be seen or concealed, such text, numbers, and seven-segment displays like those used in digital clocks. They both make use of the same fundamental technology, however different displays have bigger parts whereas random pictures are made up of a lot of tiny pixels.

Depending on how the polarizers are arranged, LCDs can either be typically on (positive) or off (negative). As an illustration, a character positive LCD with a backlight will have black writing on a backdrop that matches the backlight, while a character negative LCD will have a black background with letters that match the backlight. To make blue LCDs seem their distinctive colour, optical filters are applied to the white parts. When compared to CRT and LED, LCDs use less electricity. Their display uses a small fraction of a mill watt, whereas LEDs use a larger fraction of a milliwatt. The contrast on LCDs is superb and they are inexpensive. Comparing LCD to cathode ray tube and LED, LCD is thinner and lighter. A 20x4 LCD display, as seen in figure 4.5.2, is a highly fundamental module that is frequently utilized in many different devices and circuits. preferred to multi-segment LEDs with seven segments and other number of segments. A 20x4 LCD has two lines that can each display 16 characters. This LCD has two registers, called Command and Data.

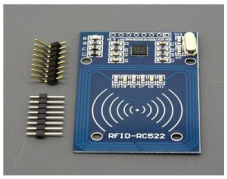


LCD Display

C. RFID

A radio frequency identification reader (RFID reader) is a tool used to collect data from an RFID tag, which is used to track particular things. Data is sent from the tag to the reader through radio waves.

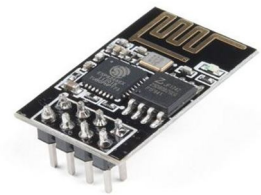
In principle, RFID works similarly to bar codes. The RFID tag does not, however, have to be immediately scanned or have line-of-sight to a reader. In order to be read, an RFID tag must be in the 3 to 300 foot reading range of an RFID reader. RFID technology provides speedy scanning of several objects and quick identification of a specific product, even when it is surrounded by numerous other things.



RFID

D. WIFI Module

The self-contained SOC with integrated TCP/IP protocol stack known as the ESP8266 Wi-Fi Module may provide your Arduino microcontroller access to your Wi-Fi network. The Express if system ESP8266 is a system on chip (SoC) module with Wi-Fi capabilities. It is mostly utilized for the creation of embedded IoT (Internet of Things) applications. It uses a 32-bit RISC processor with an 80 MHz clock speed based on the Tensilica Xtensa L106 (or over clocked to 160 MHz). There are 96 KB of data RAM, 64 KB of instruction RAM, and 64 KB of boot ROM. Through SPI, external flash memory may be accessed. A low-cost standalone wireless transceiver that may be utilized for end-point Internet of Things advancements is the ESP8266 module. A series of AT instructions must be used by the microcontroller in order to connect with the ESP8266 module. ESP8266-01 module and microcontroller interact using a UART with a predetermined Baud rate.



WIFI Module

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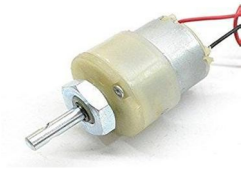
E. DC Motor

Any of a group of rotating electrical devices known as DC motors transform electrical energy from direct current into mechanical energy. The majority of kinds rely on the magnetic field's forces. For a portion of the motor's current to sometimes shift direction, almost all types of DC motors contain an internal mechanism that is either electromechanical or electronic. Due to its ability to be supplied by existing direct-current lighting power distribution networks, DC motors were the first type of motor that was widely employed. A DC motor's speed may be varied across a large range by varying the supply voltage or the amount of current flowing through its field windings. Appliances, toys, and tools all employ small DC motors.

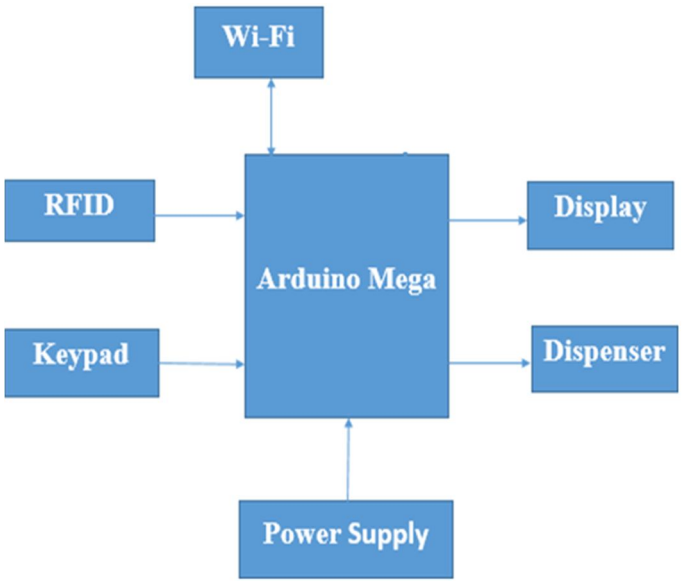


DC Motor

IV. SYSTEM ARCHITECTURE

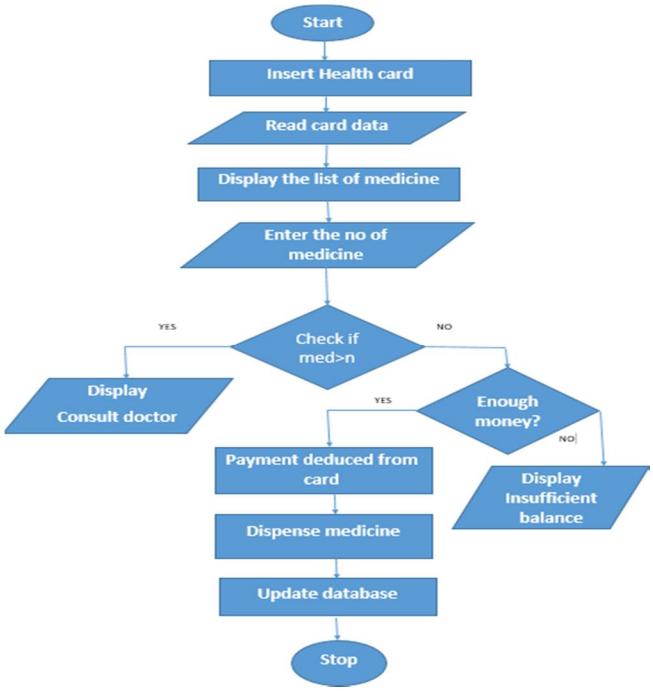
The All Time Medicine and Health (ATMVM) gadget may be broken down into two primary components that are crucial to its operation, namely the homepage, web server, Android application, and the Raspberry Pi processor based on ARDUINO UNO. The systems and subsystems of these two elements have been described in great length in this section, along with their design and operation. Along with these two primary components, we also created a mobile application that, while having similar features to the website, is simpler to use on a phone. The universal motor, a light-weight brushed motor used for portable power tools and appliances, is capable of running on direct current. Larger DC motors are being employed for steel rolling mill drives, elevator and hoist propulsion, and electric vehicle propulsion. AC motors may now be used in many applications in place of DC motors thanks to the development of power electronics.

System architecture is a conceptual model that describes a system's structure, behavior, and other perspectives. An architecture description is a formal description and representation of a system that is set up to facilitate analysis of its components' structures and actions. The Arduino Mega microcontroller, an 8-bit RISK microcontroller board, is used in the system to manage all of its component functions. The hardware parts of the system are linked together, including the RFID module, Keypad module, LCD module, GSM module, Wi-Fi module, and Dispenser.



An algorithm, workflow, or process is represented by a flowchart, a type of diagram. A diagrammatic depiction of an algorithm is another definition of a flowchart (step by step approach to solve a task).

The flowchart displays the stages as a series of boxes of varying sizes, with arrows joining the boxes in the correct order. This diagrammatic illustration shows a potential solution to a given issue. In many different disciplines, flowcharts are used in the analysis, design, documentation, or management of a process or programme.



V. APPLICATION AND FUTURE SCOPE

Everyone needs medicine at some point in their life in the modern world where health issues are getting more and more prevalent, but not everyone gets the right medication and treatment on time. According to statistical analyses conducted by the OECD in 2014, many nations' healthcare spending was so low as to be regressive, and the majority of the healthcare services provided to the populations of the countries with low incomes were not accessible to them. Even lower than expected, according to the poll, was the availability of medical professionals per 1,000 people.

400 million people worldwide lack access to basic health care, according to a 2015 WHO and World Bank Group study. As a result of having to pay for their medical care, the survey also discovered that 6% of people in 37 different nations were either forced into or pushed deeper into extreme poverty. Although things have changed since then, there is still room for development and improvement. Due to expanding services, coverage, and spending by both public and private entities, healthcare in India has grown to become one of the greatest industries in terms of employment and income.

In rural India, the Primary Health Centers (PHCs) lack more than 3000 doctors. One study reported that 143 public facilities discovered absenteeism of 45% doctors from PHCs with 56% of the time observed to be closed with an erratic pattern of closure and absence during normal hour visits. This indicates that many residents in rural regions continue to lack access to appropriate medications or quick access to medical advice. We wanted to offer a solution to this issue with this initiative. No one needs to suffer from a lack of medical care thanks to the ATMVM device's rapid and effective diagnostic and medication delivery. Since installing a vending machine is easy and affordable, even remote locations may have the ATMVM devices installed. This gadget can be extremely helpful in rural and distant places where such amenities are not readily accessible. Most significantly, this gateway can assist patients in obtaining the necessary medication(s) swiftly in an emergency with the approval of a qualified doctor. It will just take an internet connection to receive the medications from the ATMVM device in locations where setting up pharmacies is challenging, such as inhospitable mountainous terrains or off-the-beaten-path highways.

This gadget not only supplies medications in urgent situations but also secures the drug industry and lowers the price of these medications in comparison to retail pharmacies. Pharmaceutical crime includes the production, trading, and distribution of fraudulent, stolen, or illegal medications and medical devices, as well as the fabrication of medical items' packaging and related paperwork and acts of theft, fraud, and illegal diversion. Online pharmacies may have brought about a welcome shift in the way drugs are distributed, but an unlawful operator invasion has jeopardized the safety of the consumer/buyer.

Today, pharmaceutical crimes have significantly escalated, and individuals all over the world put their health, and sometimes even their lives, in danger by unintentionally taking fake medications or real medications that have been doctored, improperly kept, or expired. Additionally, there are more instances of people buying medications at pharmacies without a prescription. The ATMVM gadget will aid in resolving these issues by securing and monitoring medication transactions. Since the patient will only be able to acquire the medications after obtaining a prescription number from the doctor, there will be no possibility to purchase non-prescription medications.

The systems may be made even more secure by connecting the devices to official identifications such as the social security number in the US or the ADHAAR number in India, which would also enable the government to monitor drug trade in the respective nations.

VI. METHODOLOGY

User authentication is a method that enables a device to confirm the identity of a person who connects to a network resource. The cardholder must insert it and type their password. The system will approve the transaction if the password is accurate, or otherwise the proper error message will be displayed.

Dispensing of Medicine: After the authentication procedure is complete, the user chooses the medication, and the pillbox dispenses it.

Database Update: The balance and database will be updated when the medication has been administered. Current balance and pill count will be updated in the user's database.

Current stock value will be added to the stock database. Controlling the medication inventory is essential for a machine to operate properly. The system will send a reminder to replenish the medication whenever it runs out.

VII. CONCLUSION

The system that we created and built is a prototype, so there is still room to add features and make it market-ready. Because of the Raspberry Pi's affordability and ease of use, we chose it above other options like BeagleBone. Blood pressure monitoring, SpO2 sensing, and other functions can be incorporated in addition to the video communication and cardiac sensors to enhance the diagnostic process. Conveyor belts and LEDs were used to demonstrate the vending mechanism, but in order to make the system functional, a real industrial vending mechanism will need to be integrated into the system in the future. In the future, a portal for online or cash payments will be added to the mobile application and GUI so that clients can pay for prescription drugs and doctor visits online. Additionally, in order to put up the ATMAH devices in various places and reach a large number of people, working with the government, commercial pharmaceutical companies, and hospitals would be crucial.

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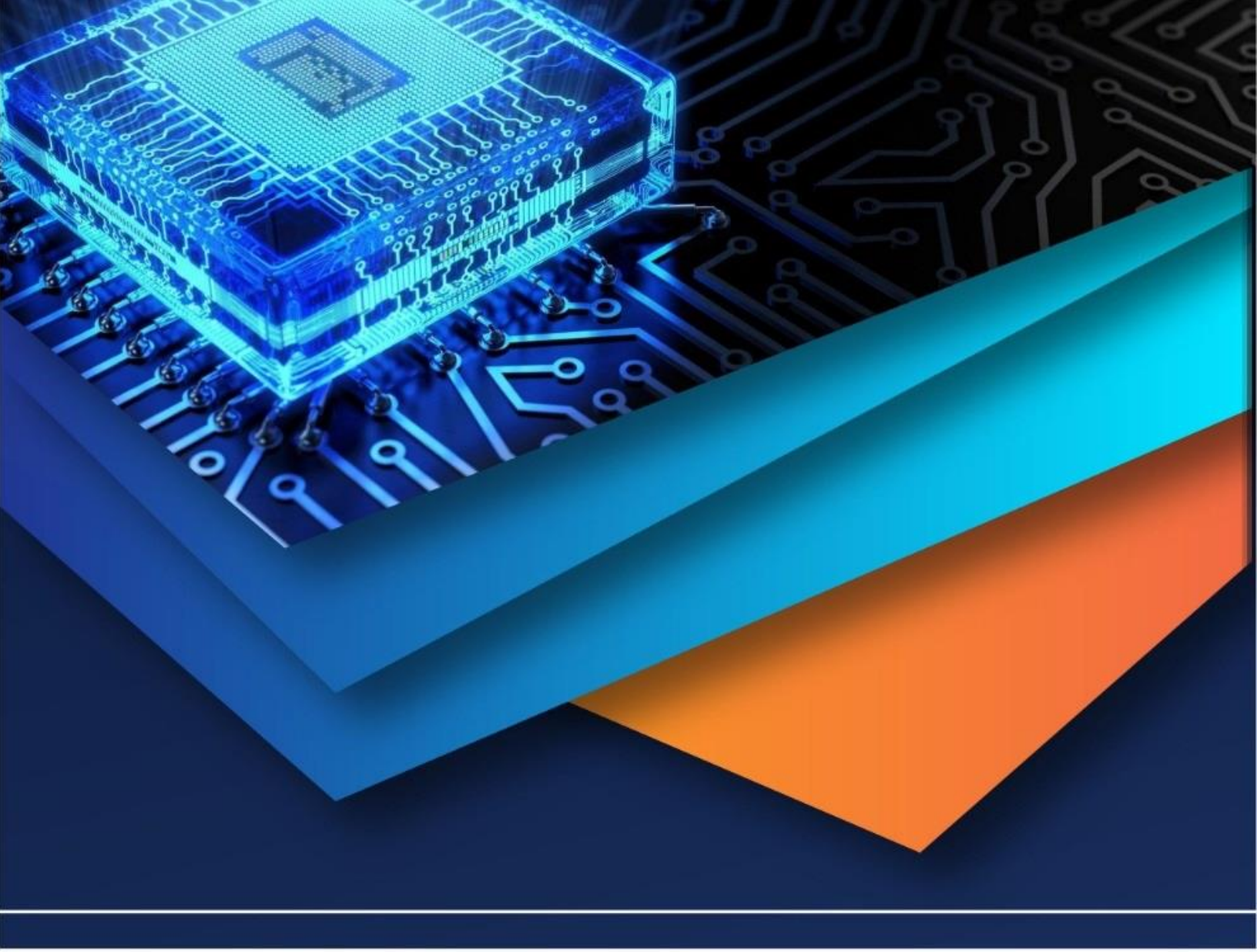

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