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Smart Entrance System with Health Monitoring

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***Abstract:** In the aftermath of the coronavirus infection (COVID-19), contact with people has become an important risk factor. It is widely believed that the risk of spreading the virus increases with the number of people in contact with other objects or people. According to the World Health Organization (WHO), high fever and heart palpitations are the two most common symptoms of COVID-19. It is also recommended to wash your hands frequently and use an appropriate mask. That's why our project is trying to create a system that checks the body temperature, mask and heart rate of people entering the facility to make sure they are safe. Also, checks if the mask is worn correctly. Hence through our project we are trying to build a system that will make sure you are protected. Immediately after that, a non-contact disinfectant is provided which guarantees minimal contact between the person and the system.*

***Keywords:** COVID19, Open Source Computer Vision, TensorFlow, mask detection, temperature sensing, pulse detection, contactless hand sanitization.*

I. INTRODUCTION

China was afflicted with a wide-spread outbreak of the new coronavirus (COVID-19) at the end of 2019 [1]. These viruses are a large family of diverse viruses that cause a variety of diseases in humans. Some people have a cold, some have migraines, and some have body aches. In the midst of such a pandemic, people's health plays an important role in their daily lives. However, the majority of the population is unaware of how to protect themselves and those around them from this threat [2]. Proper masking, physical separation, and hand hygiene are important to prevent the spread of the COVID19 virus. Masks alone cannot prevent the virus and should be used in combination with regular hand washing and disinfection. With the rapid spread of (Covid19), various countries are facing a public health epidemic.

To prevent Covid19, many places have created entrance systems where people manually check a person's temperature, mask, and disinfects them using sanitizer. This leads to no observation of social distance, also manual checkouts are not feasible for many and may even ignore each person's disinfection. Therefore, we have researched an entrance system that provides face masks detection and non-contact temperature checks after this process it provides sanitization. At the very least, this measure helps workers to live away from the comforts of their homes and resolve the economic imbalances caused by Covid19 while taking some precaution. Ultimately, our research led to the development of a fully automated inlet system consisting of a non-contact temperature scanner and a mask monitor system which checks pulse and also provides sanitization. The human barrier is directly connected to the motor and is opened when entire process is complete.

The Open Source Computer Vision (OpenCV) framework offers a pre-trained model for recognizing the faces. The Raspberry Pi 3 receives the facemask data captured by the camera and processes it. This system will detect individuals wearing a facemask on an image/video stream carried out using different libraries such as OpenCV, Keras, TensorFlow, and others. The photos are categorized as "mask" or "no mask also the MLX90614 sensor will be used to measure the temperature [3].

II. LITERATURE REVIEW

In [1] Li, Lixiang et. al. investigates study of the Corona Virus Disease 2019 transmission mechanism using official data modeling (COVID-19). Due to its exceptional spreading capacity and potential harm, the new coronavirus has posed a serious danger to people's health and safety all across the world. The study of local and worldwide epidemics, as well as the future development tendency, is a popular issue in contemporary research. Many teams are now researching the COVID-19 transmission legislation and prevention methods. The difference between the official data curve and the model is relatively minor. Simultaneously, it achieved forward prediction and backward inference of the pandemic scenario, with the appropriate analysis assisting relevant nations in making judgments.

In [3] NaveenKumar K et. al. concluded that there are two key protocols that must be followed in public areas to prevent the virus from spreading further: wearing face masks and maintaining safe social distance. This paper propose a dynamic Computer Vision-based automated solution system focused on real-time face monitoring of people in public places to detect both face mask protocol violations and body temperature using a Raspberry Pi 4 Model B to detect face mask protocol violations through an integrated Pi camera and to monitor body temperature using an MLX90614 sensor to create a safe, COVID-19-free environment. A security clearance system is deployed that will allow that person to enter if they are wearing a face mask and their body temperature is in check with WHO guidelines.

In [5] Prof. V. M. Bonal P et. al. shown that COVID-19 has harmed over 127 million people globally and killed over 2 million. This study proposes a dynamic Computer Vision-based automated solution system that focuses on real-time face monitoring of individuals and detecting palm print for identification of a person utilizing a Raspberry Pi 3 Model B with an inbuilt Pi camera and an MLX90614 temperature sensor. An Internet of Things (IoT) based electronic mail alert system is being implemented, which will verify if people are wearing a face mask and their body temperature is within WHO standards. This can be implemented in public places such as colleges, schools, offices, malls, etc. to inspect people.

In [6] According to Ashlesha D. Mahalle et. al. research hand cleaning will assist prevent the transmission of any sickness that spreads by contact. A dependable and cost-effective technique of applying artificial intelligence is created for a healthy working environment in a manufacturing environment. For mask detection, a hybrid model integrating deep and conventional machine learning is to be suggested. A face mask recognition dataset consists of images with and without masks. They have used a Raspberry Pi to recognize faces from a live flow from the webcam in real time. The best applications for infrared thermography sensors are temperature measurement and non-destructive tracking.

In [7] Swapnil Kumbhar 's et. al. researches has shown that the the COVID-19 pandemic has pushed us to embrace some changes and made us more cautious, according to Swapnil Kumbhar's research. Present, sanitizers are the most important goods. According to WHO's new norms and regulations, a high level of sanitization is required to live. The article provided a solution to the problem. The article proposes an automatic hand sanitizer with a temperature detecting system that allows a person to sanitize their hands anytime they want, without having to touch the sanitizing equipment. When the temperature sensor is touched, it displays the person's body temperature. If the body temperature is normal, the door will automatically open; otherwise, it will remain close.

In [8], Tejaswini N discovered that detecting face masks has become a critical duty in preventing virus spread and assisting the worldwide population. This paper describes a real-time face mask recognition system that detects whether a person is wearing a face mask and alerts security agencies if he or she is not. It can be used in places where the public congregates frequently, such as shopping mall entry and exit gates, office buildings, resorts, healthcare facilities, railway stations, and other public areas. Pre - processing the gathered dataset, training the processed information using Convolutional Neural Network (CNN) model, and also using certain Machine learning packages like KERAS, Tensor flow, Open CV, and Scikit-learn are all part of the methodology that they have implemented.

In [9] According to Saman M. Almufti et al. Facemask detection has been a notable development in the Image processing and deep learning areas research, Various methods and strategies have been used to create a variety of face detection models. The proposed method in this paper was created to prevent mask-less people from entering preferred places (e.g., malls, universities, offices, etc.) by detecting face masks using deep learning, TensorFlow, Keras, and OpenCV and sending signals to an Arduino device connected to the gate to be opened. It detects a person's face in real time and determines whether or not they are wearing a mask. The technique has a precision of approximately to 97.80%.

III.PROBLEM STATEMENT

India, alongside practically all other small and large countries, recently declared an emergency for the new coronavirus (COVID-19). Almost the entire world's population is on lockdown, and everyone is wearing a mask and hand sanitizer as recommended by the World Health Organization (WHO). It is always best to be safe and precautious. However, because there is no proper remedy at this time, the only alternative we have is to obey the measures, and failure to do so might result in serious problems. Because there is no proper medical care in the current movement, the only way to be safe is to take measures. It is recommended that you use a face mask since masks assist to reduce the transmission of infection because the viruses are communicated mostly by particulates that come out of an infected person's nose or mouth while sneezing or coughing. Contactless Thermometer is now used by the person in charged to check temperature of other people entering the premises. Physical inspections are inefficient, impracticable, and dangerous. To address these issues, we created a Raspberry Pi-based contactless body temperature sensor and a face mask detection that identifies whether or not someone is wearing a mask. We also have an automated hand sanitizer with pulse detection.

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IV. PROPOSED METHODOLOGY

In this work, we provide an automatic system that addresses numerous important elements such as contactless monitoring of temperature, mask identification, and automatic hand sanitization, with the goal of improving Covid-19 entry safety. It's a completely computer based system. No one is permitted to enter if they are not wearing a mask and the temperature is high. If a fail-safe condition is discovered, the buzzer will warn the security of the problem. Initially, the motion of the individual is used to identify the person. The temperature of the individual is measured using a temperature sensor, and if it exceeds the maximum temperature limit, an alarm message is sent.

If temperature is normal then, at the same time, the image is captured by the camera. The categorization of whether an individual is wearing a mask or not is confirmed using OpenCV and tensor flow. When a person inserts his or her hand beneath the sanitizer, the proximity sensor recognizes this and pumps the sanitizer appropriately. After this the gate opens and each individual can check their heart rate with the help of pulse sensor. This system can be used in offices, hospitals, airports, banks, sports facilities, the entertainment industry, restaurants and densely populated areas. This system aims to support society by reducing the spread of COVID19 and saving time. The system will work effectively in the current situation where the blockade has been relaxed and public meetings, malls, church meetings and school reopening are now possible. This automated control minimizes the number of personnel required for assembly inspections and is ready to use in all situations. In the fig. 1 below, each phase of the planned task is demonstrated graphically, also in fig. 2 flow chart of the overall system is shown.

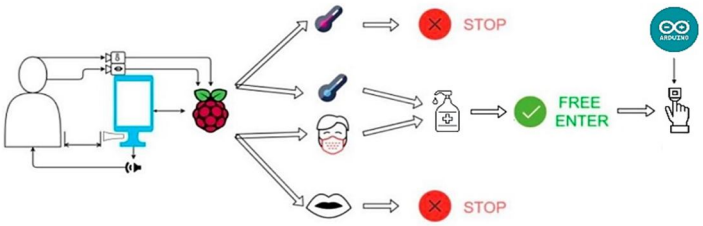

Fig. 1 General diagram of the proposed system

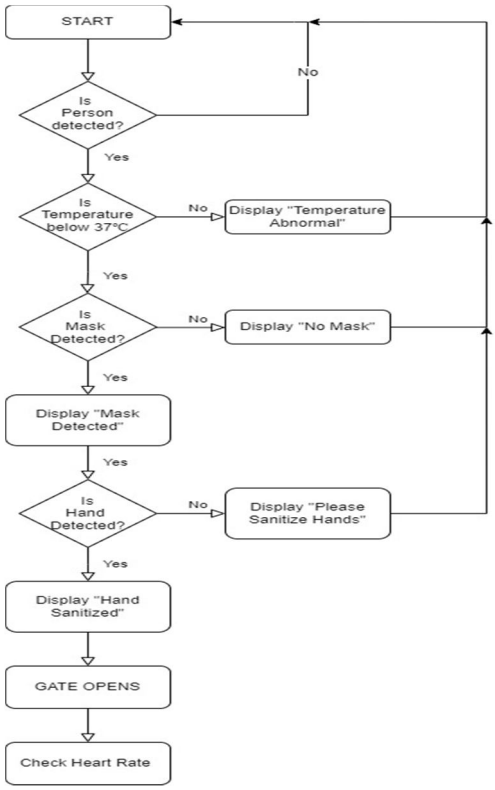

Fig. 2 Flow chart of the system

V. REQUIREMENTS

A. Raspberry Pi3 Board

In this work, we provide an automatic system that addresses The Raspberry Pi 3 has a quad-core 64-bit Broadcom BCM2837 ARM Cortex-A53 SoC (System on a chip) CPU with a clock speed of 1.2 GHz, makes it around 50% faster than the 0050i 2. As a result, the new Raspberry Pi 3 may be used for both professional and online surfing. The inclusion of a Wi-Fi microchip and Bluetooth Low Energy is certainly the most significant advancement in this current version. This not only saves space by eliminating the need for Wi-Fi and Bluetooth dongles, but it also frees up extra USB ports for other devices. Raspberry Pi has made it obvious that such a new edition is oriented toward the Internet of Things (IoT) and home automation by including these key functionalities. The Raspberry Pi 3 is also compatible with Windows 10 IoT Core, an operating system aimed for home automation, robotics, and connecting devices.

Features: Clock frequency: 1.2 GHz, Chipset: Broadcom BCM2837, Processor: 64-bit quad-core ARM Cortex-A53, Memory (SDRAM): 1 GB LPDDR2, Number of USB 2.0 ports: 4.

B. MLX90614(Temperature sensor)

The MLX90614 is a Contactless Infrared (IR) Digital Temperature Device used for measuring the temperature of a specific body between -70° C to 382.2°C. The sensor measures the temperature of the item using infrared rays without making human touch, and interacts with the microcontroller using the I2C protocol.

C. Arduino Uno

Arduino Uno is a microcontroller board that uses ATmega328P (data sheet). The board has 14 digital I / O pins (6 of which can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power connector, an ICSP header, and a reset button. It includes everything needed to get started with the microcontroller; simply plug it into a computer with a USB connection or power it with an AC-to-DC converter or battery. An external power supply or a USB connection can be used to power the Arduino Uno board. The power supply will be selected automatically. An AC-to-DC adapter or a battery can provide external power.

D. Pi Camera

The camera module can be used to capture high resolution video as well as still images. Great for drones, CCTV and other Raspberry Pi projects. Due to the compact size and lightweight features of the Raspberry Pi camera board, it is compatible and can be used as a hidden camera for Pi phones. It supports 1080p30, 720p60, VGA90, video modes, and still images. Connect to the CSI port on your Raspberry Pi via a 15 cm ribbon cable. The camera consists of a small (25mm x 20mm x 9mm) circuit board connected to the Raspberry Pi's Camera Serial Interface (CSI) bus connector via a flexible ribbon cable. The camera's image sensor has a native resolution of 5 megapixels and comes with a fixed focus lens. The camera software supports full resolution still images up to 2592 x 1944 and video resolutions of 1080p30, 720p60, and 640x480p60 / 90.

E. Sanitization pump

Micro DC36V Micro Submersible Mini Water Pump is used for water circulation system. This is a low cost small submersible pump motor that can operate from a 3-6V power supply. It can absorb up to 120 litres per hour with a very low power consumption of 220mA. Simply connect the tube to the motor output, immerse it in water and turn it on. Make sure the water level is always higher than the motor itself. When dry, the motor can heat up and be damaged, producing noise.

F. Pulse Sensor

An alternate call of this sensor is heartbeat sensor or coronary heart rate sensor. The operating of this sensor may be carried out through connecting it from the fingertip or human ear to Arduino board. So that coronary heart rate may be effortlessly calculated. The pulse sensor consists of a 24 inches' colour coded cable, ear clip, Velcro Dots-2, obvious stickers-3, etc. A colour coded cable is hooked up to header connectors. So this sensor is effortlessly linked to an Arduino without any soldering. An ear clip length is similar to a coronary heart rate sensor and it may be linked with the usage of warm glue on the bottom of the sensor to put on at the earlobe. Two Velcro dots are absolutely sized towards the sensor on the hook side. These are extraordinarily beneficial at the same time as creating a Velcro strap to cowl about a fingertip. This is used to cowl the Sensor across the finger. Transparent strikers are safety layers used to defend the sensor from sweaty earlobes and fingers.

G. Infrared sensor

IR sensors are electronic devices that emit light to detect objects in the environment. IR sensors can not only measure the heat of an object, but also detect its movement. Normally, all objects in the infrared spectrum emit some form of heat radiation. These types of radiation are invisible to our eyes, but infrared sensors can detect them. The emitter is simply an IR LED (light emitting diode) and the detector is simply an IR photodiode. Photodiodes are sensitive to IR light of the same wavelength emitted by IR LEDs. When the IR light hits the photodiode, the resistance and output voltage change in proportion to the magnitude of the received IR light. The infrared (IR) sensor module has a pair of infrared transmit and receive LEDs. The IR emitter LED is connected to a 5-volt power supply with current limiting resistance. Therefore, it emits infrared rays continuously. There are two types of infrared sensors, active and passive. An active infrared sensor emits and detects infrared rays. As the object approaches the sensor, the infrared light from the LED is reflected by the object and detected by the receiver. Passive infrared (PIR) sensors only detect infrared rays and do not emit light from the LEDs.

H. DC (Direct current) motor

1000 RPM (Revolutions per minute) -12 volt geared motors are usually simple DC motors with a gearbox attached. These motors have a 3mm hole in the centre of the shaft for easy interface with other mechanical assemblies. 1000RPM 12V DC gear motors are widely used in robotics applications. Very easy to use and available in standard size. The most popular Hbridge module with integrated voltage regulator motor driver can be used with this motor with a voltage of 5 to 35V DC.

I. Liquid Crystal Display

LCD is a type of flat panel display that uses liquid crystal in its main mode of operation. LEDs have a variety of consumer and business use cases, as is often found in smartphones, televisions, computer monitors and instrument panels. LCD modules are very widely used in most embedded projects. The reason is that it is cheap, readily available, and suitable for programming. Most of us would have encountered these displays in our daily lives, either with a PCO or a calculator.

J. Buzzer

A buzzer is a small but efficient component for adding sound functionality to the project / system. It's extremely small and compact 2-pin construction makes it easy to use on breadboards, performance boards and even PCBs, making it a widely used component in most electronic applications. There are two types of buzzers commonly available, one which continuously beeps and the other type is called a readymade buzzer which will look heavier and produces a Beep Sound due to the internal circuit. The buzzer can be used simply by powering it with a DC power supply in the range of 4V to 9V.

VI. RESULT

The proposed system is a total of 5 blocks. The first block is for mask detection and contains the Pi camera. The second block is for temperature measurement and contains the MLX90614 sensor and IR sensor. The third block is for disinfection and uses a mini submersible water pump for sanitization purposes. The fourth block is used for pulse detection performed using the pulse sensor. The last block that is the fifth block, which is the output, this includes a buzzer, an LCD module that displays commands and outputs, and a DC motor for gate opening and closing.

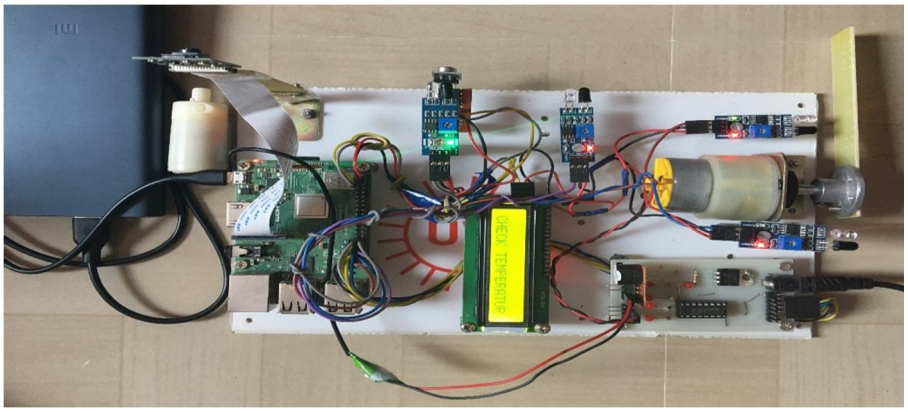

Fig. 3 Final output model

VII. CONCLUSIONS

The main goal of this project is to automate the Covid-19 protocol's manual work, check the temperature, and verify if anyone is wearing masks. This system can control the spread of the Covid19 virus and the temperature check will be more accurate than if done manually. Employee and student health and care needs do not have to be related to a particular management agency. Lack of attention from staff checks can also be addressed by this system. In the future, we will be able to further improve the accuracy of mask detection, and there is plenty of room for further development in our project for security systems and any other outbreak prevention. Using this project implementation, it will prevent people from getting effected by life-threatening situations which will help them to be more safe. In summary, face mask, body temperature, sanitization and pulse sensing awareness helps to reduce the large collection of people in places without a mask and reduce the risk of infectious diseases.

VIII. ACKNOWLEDGMENT

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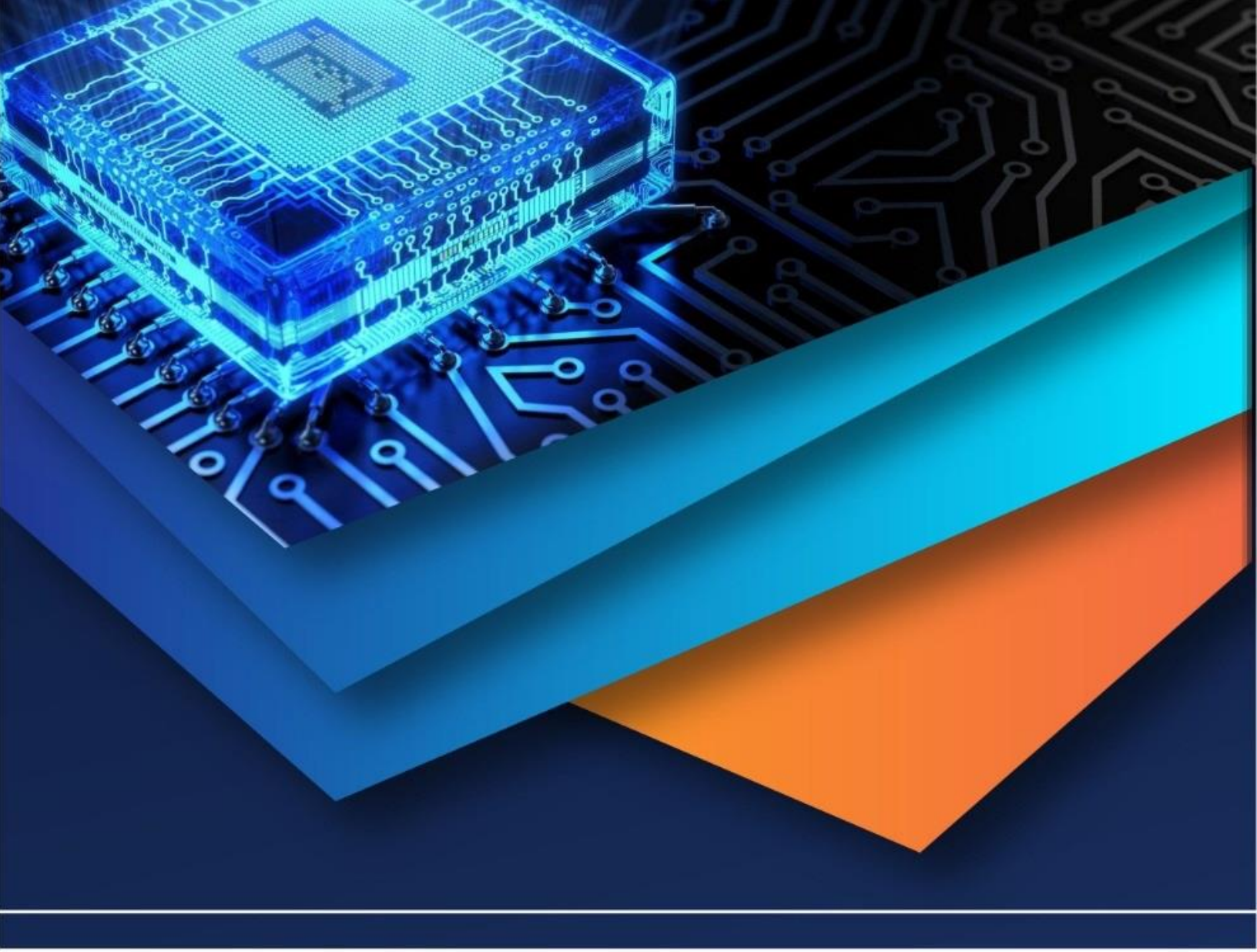

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