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Smart Band for Monitoring Vitals forElderly People in Quarantine

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Abstract: ***Corona virus disease 2019 (COVID-19) has emerged as a pandemic with serious clinical manifestations including death. A pandemic at the large-scale like COVID-19 places extraordinary demands on the world's health systems, dramatically devastates vulnerable populations, and critically threatens the global communities in an unprecedented way. While tremendous efforts at the frontline are placed on detecting the virus, providing treatments and developing vaccines, it is also critically important to examine the technologies and systems for tackling disease emergence, arresting its spread and especially the strategy for diseases prevention. The objective of this article is to review enabling technologies and systems with various application scenarios for handling the COVID-19 crisis. The article will focus specifically on 1) wearable devices suitable for monitoring the populations at risk and those in quarantine, both for evaluating the health status of caregivers and management personnel, and for facilitating triage processes for admission to hospitals; 2) unobtrusive sensing systems for detecting the disease and for monitoring patients with relatively mild symptoms whose clinical situation could suddenly worsen in improvised hospitals; and 3) telehealth technologies for the remote monitoring and diagnosis of COVID-19 and related diseases. Finally, further challenges and opportunities for future directions of development are highlighted.***

I. INTRODUCTION

Corona virus disease 2019 (COVID-19) has emerged as a pandemic with serious clinical manifestations including death. A pandemic at the large-scale like COVID-19 places extraordinary demands on the world's health systems, dramatically devastates vulnerable populations, and critically threatens the global communities in an unprecedented way. While tremendous efforts at the frontline are placed on detecting the virus, providing treatments and developing vaccines, it is also critically important to examine the technologies and systems for tackling disease emergence, arresting its spread and especially the strategy for diseases prevention. The objective of this project is to review enabling technologies and systems with various application scenarios for handling the COVID-19 crisis. COVID-19 is a chronic condition or disease that causes inflammation and narrowing of the tubes, the passageways that allow air to enter and leave the lungs, making it harder to breathe, if people with COVID-19 are exposed to a substance to which they are sensitive or a situation that changes their regular breathing patterns, the symptoms can become more severe. According to the latest World Health Organization (WHO) estimates, approximately 250 million people suffer from COVID-19worldwide, and almost 250 million Americans are affected by this disease according to AAFA, this disease is a public health problem in both rich Smart Band for Monitoring Vitals for Elderly People in Quarantine and poor countries. Although there is no cure for COVID-19, effective treatments are available. The best way to manage COVID-19 is to avoid triggers, take medications to prevent symptoms and prepare to treat COVID-19 episodes if they occur. Currently, more than 300 million cases COVID-19 of varying severity have been detected worldwide. In addition, there is a tendency to an increase in the number of patients with COVID-19, including young children. Therefore, the development of new methods and devices for the diagnosis of COVID-19, including inexpensive portable devices, is a very urgent task. Modern technologies are able to provide important tools for diagnosing a wide range of various diseases, including COVID-19. At present, one can find a tendency to actively introduce modern technologies, in particular, in the development of modern low-cost portable devices for diagnosing or monitoring human condition. COVID-19 is one of the most common chronic diseases and the third leading cause of hospitalization among adolescents. It is a medical condition that causes coughing, wheezing, and difficulty in breathing. During the period from 2008–2010, the prevalence of COVID-19 was higher among children than adults. According to the Centre for Disease Control, it affects 7.1 million (1:11) children and its rampancy has increased by 15% in the last decade. Records obtained from the Centre for Disease Control and Prevention also indicate that in 2013, about 21% of high school students (grades 9-12) had COVID-19. COVID-19 demands a great deal of health care utilization and entails a lot of missed days of school and work.

COVID-19 can be monitored by the following people:

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The patient withCOVID-19 because self-monitoring allows the early detection of exacerbations. The treating physician to assess control of COVID-19and investigate reasons for poor control; and Health care managers to assess the quality and cost of care for patients with COVID-19. COVID-19 is a chronic disease affecting one in nine Australians. As of 2014, 1.5 out of every 100, 000 deaths in Australia were due to COVID-19. People with COVID-19 have sensitive airways which react to environmental triggers, causing 'flare ups. This is when muscles in the wall of airways tighten and swell, narrowing the airway itself. This, in combination with the production of mucus can block the airway to varying degrees. Resulting in symptoms such as coughing, wheezing, tightness in the chest and shortness of breath, making it extremely difficult to breathe instrumented glove which utilizes electromyography, inertial measurement or electromagnetic to collect finger flexion, position, orientation or angle data of the sign performed. Vision-based approaches uses data collected from images or video frames captured using camera as input of the system. It can be further divided into 3D model-based and appearance-based approaches 3D model- based approaches generally attempt to infer the pose of palm and joint angle hand in 3D spatial into 2D projection. Whereas appearance-based uses regions. Features extracted from visual appearance of the images and recognition is done by comparing these features. Vision-based approach is often preferred over contact-based approaches as it often does not involve the wearing of instrumental gloves or other hardware besides camera to perform the recognition process. In some vision-based research however, colored gloves are used to alleviate the hand segmentation process. The major challenges faced by visual based approach is that the accuracy is often affectedby noises, lighting condition, variation of viewpoint and the presence of complex background. Sign language recognition in general involves a few phases of process namely the segmentation, feature extraction and classification. The main objective of the segmentation phase is to remove the background and noises, leaving only the Region of Interest (ROI), whichis the only useful information in the image. In the feature extraction phase, the distinctive features of the ROI will be extrac ted. These features can be the curvatures, edges, shapes, corners, moments, textures, colors or others. In the context of sign language recognition, these features are essentially analogous to the identity of each sign language gesture. Next, the features extracted will undergo classification whereby the features of each gesture will be grouped accordingly, and this will be used as a database to match new sign language gesture inputs to which of the groups classified earlier do, they belong.

II. RELATED WORK

Estimating instant case fatality rate of COVID-19 in China by Yan-niMi, Ting-ting Huang and published in International Journal of Infectious Diseases, 2020: For an unprecedented epidemic such as COVID-19, it is important to assess its hazards. The case fatality rate (CFR) is the ratio of the number of deaths divided by the number of confirmed cases over a certain period of time. This is the most direct index to reflect the lethality of the disease. Since the occurrence of the epidemic in China, the CFRs of COVID19 have been examined in many studies published in the literature. However, the literature on CFRs of COVID-19 is subject to several limitations. When a pandemicis still ongoing, the resulting CFR (the number of deaths divided by the number of confirmed cases), called the naive CFR, does not represent the true CFR (Kucharski and Edmunds, 2014).

Case-Fatality Rate and Characteristics of Patients Dying in Relation to COVID-19 in Italy by Graziano Onder 1, Giovanni Rezza 2, Silvio Brusaferro 3 and published in JAMA, 2020: Only 3 cases of coronavirus disease 2019 (COVID-19) were identified in Italy in the first half of February 2020 and all involved people who had recently traveled to China. On February 20, 2020, a severe case of pneumonia due

SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2) was diagnosed in northern Italy's Lombardy region in a man in his 30s who had no history of possible exposure abroad. Within 14 days, many other cases of COVID-19 in the surrounding area were diagnosed, including a substantial number of critically ill patients. On the basis of the number of cases and of the advanced stage of the disease it was hypothesized that the virus had been circulating within the population since January. A second possible explanation for the high Italian case-fatality rate may be how COVID-19–related deaths are identified in Italy. Case-fatality statistics in Italy are based on defining COVID-19–related deaths as those occurring in patients who test positive for SARSCoV-2 via RT-PCR, independently from preexisting diseases that may have caused death.

Comparative replication and immune activation profiles of SARS-CoV-2 and SARSCoV in human lungs: an ex vivo study with implications for the pathogenesis of COVID19 by HinChu,JasperFuk-Woo Chan and published in: IEEE 2020: Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is an emerging coronavirus that has resulted in nearly 1,000,000 laboratory-confirmed cases including over 50,000 deaths. Although SARS-CoV-2 and SARS-CoV share a number of common clinical manifestations, SARS-CoV-2 appears to be highly efficient in person-to-person transmission and frequently cause asymptomatic infections.

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However, the underlying mechanism that confers these viral characteristics on high transmissibility and asymptomatic infection remain incompletely understood. Methods: We comprehensively investigated the replication, cell tropism, and immune activation profile of SARS-CoV-2 infection in humanlung tissues with SARS-CoV included as a comparison. Results: SARS-CoV-2 infected and replicated in human lung tissues more efficiently than that of SARS-CoV. Within the 48-hour interval, SARS-CoV2 generated 3.20 folds more infectious virus particles than that of SARS-CoV from the infected lung tissues (P<0.024).

Potential applications of wearable sensors in closed-loop management of STEMI patients during pandemics by Xiaorong Ding and published in: 2020May 2020IEEE Reviews in Biomedical Engineering: The objective of this article is to review enabling technologies and systems with various application scenarios for handling the COVID-19 crisis. The article will focus specifically on 1) wearable devices suitable for monitoring the populations at risk and those inquarantine, both for evaluating the health status of caregivers and management personnel, and for facilitating triage processes for admission to hospitals 2) unobtrusive sensing systems for detecting the disease and for monitoring patients with relatively mild symptoms who's clinical situation could suddenly worsen in improvised hospitals and 3) telehealth technologies for the remote monitoring and diagnosis of COVID-19 and related diseases. Finally, further challenges and opportunities for future directions of development are highlighted.

Prospects for Designing a Portable System for Monitoring of the Patient's Condition with COVID-19 by Ivan V. Semernik, Alexander V. Dem'yanenko and published in: 2019 IEEE in this article the prospects and possibilities for creating an individual wearable system for monitoring the condition of a patient suffering from COVID-19 and preventing attacks of the disease are discussed. As the basic method of determining the condition of the patient is considered the technique for determining the transmission coefficient of a certain frequency microwave signal through the chest. The proposed method is non-invasive and harmless and can be used for patients of all age groups.

Detection and Monitoring of COVID-19 Trigger Factor using Zigbee by Miss. AnumehaLal , Mr. Girish A. Kulkarni and published in: International Advanced Research Journal in Science, Engineering and Technology, Vol. 3, Issue 7, July 2016: , the aim of this study is to develop a system, which is based on a periodical data collected by the different sensors. There is no cure for COVID-19. Symptoms can be prevented by monitoring factors which can trigger COVID-19 attack. So it is very much needed that there should be a system which can monitor air parameter on regular basis and warn the patient when these factor can trigger their COVID19 attack Wireless sensor networks in monitoring of COVID-19 by DinkoOletic and published in: IJRSE 2013: Effectiveness of home peak flowmetry is analyzed. Employment of low power wireless sensor networks (WSN) paired with smartphone technologies is reviewed as a novel COVID-19 management tool. Using the technology, the aim is to retain the disease in a controlled state with minimal effort, invasiveness and cost, and assess patient's condition objectively. WSN-s for sensing of both COVID-19 triggers in the environment, and continuous monitoring of physiological functions, in particular respiratory function are reviewed. Sensing modalities for acquiring respiratory function are presented. Signal acquisition prerequisites and signal processing of respiratory sounds are reviewed. Focus is put on low-power continuous wheeze detection techniques. At the end, research challenges for further studies are identified.

Monitoring the patient with COVID-19: An evidence-based approach by Harold S. Nelson, MD and published in: Apr 17, 2000: The monitoring of symptoms, airflow obstruction, and exacerbations is essential to COVID-19 management. Patients who practice self- monitoring in conjunction with use of a written action plan and regular medical review have significantly fewer hospitalizations, emergencydepartment visits, and lost time from work. Either symptom monitoring or peak expiratory flow.

III. PROPOSED SYSTEM

The COVID-19 Monitoring System is designed around a microcontroller for gathering, sending and receiving information from different sensors and external servers. The aim of the architecture design is to provide an easier access to information and services, better patient healthcare services, transparent and efficient use of healthcare resources, and a fast response by the hospital side if positive case of COVID- 19 attack. Symptoms can be predicated by monitoring factors which can trigger COVID-19 attack. Therefore, it is very much needed that there should be a system which can monitor air parameter on regular basis and warn the patient when these factors can trigger their COVID-19 symptoms. A portable system for non-invasive diagnosis of Broncho pulmonary diseases and continuous monitoring of the patient's condition is a combination of two compact modules.

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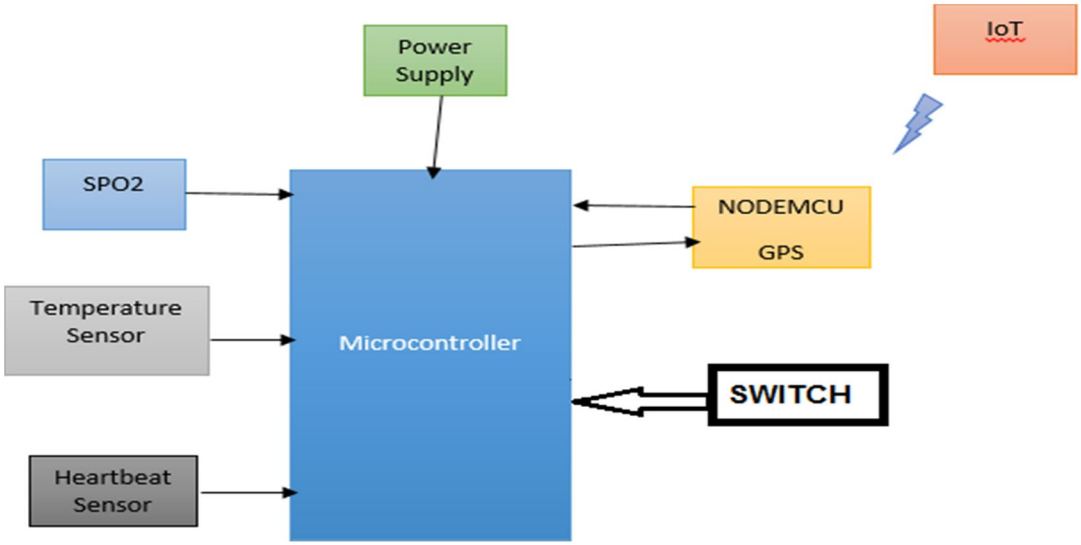

Figure: Architecture of the Proposed System

IV. IMPLEMENTATION

A. Setting Up Telegram Application

Telegram is a free and open source, cross-platform, cloud-based instant messaging (IM) software. All of Telegram's official components are open source, with the exception of the server which is closed-sourced. Telegram provides end-to-end encrypted voice and video calls. Cloud chats and groups are encrypted between the app and the server, so that ISPs and other third-parties on the network can't access data, but the Telegram server can. Users can send text and voice messages, animated stickers, user locations, contacts, and audio files. A bot needs to be created in Telegram in order to send message to the mobile application in order to monitor the vitals. For this purpose, the command /new bot is used. A name is given to the bot created and used command /start to start the bot. Once the bot is created, the user will be receiving information about the vitals of the patients through the telegram application which can be monitored constantly.

B. Setting Up Blynk Application

Blynk is a hardware-agnostic IoT platform with white-label mobile apps, private clouds, device management, data analytics, and machine learning. Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data and visualize it. A new project is used to create a project for monitoring the vitals of the patient.

This module consists of the functionality of the device. The Arduino NANO is an open-source microcontroller board based on the Microchip ATMega328P microcontroller and developed by Arduino. The ATMEGA328 on the Arduino Uno is pre- programmed with a bootloader which allows uploading new code without the use of an external hardware programmer. It communicates with original STK500 protocol. The Arduino is a single-board microcontroller which provides solution to many projects. Install the Arduino IDE. Arduino IDE is an open-source software which is mainly used to write and compile the code into the Arduino Module. Arduino software makes code compilation too easy that even a common person with no prior technical knowledge can learn the process. The text editor at the middle part is where you can enter the program code. The output window at the bottom section is used to see the status of the compilation, memory usage, any errors found in the code, and other useful messages and suggestions. Projects made using the Arduino are called sketches, sketches are usually written in a cut-down version of Since programming a microcontroller is different from programming a computer, there are a number of device-specific libraries. Arduino is open-source hardware. The hardware is distributed under a Creative Commons Attribution Share-Alike 2.5 license and are made available on the Arduino website. Layout and production files versions of the hardware are availablefor download. The boards use single or double-row pins or headers that help with connections for programming and incorporating to other circuits. The transformer 230Volts will be stepped down to 12-0-12 one side of the 12V is given to the 7805 and Lm317.For this project the microcontroller requires +5V power supply. The design description of power supply is given as follows: +5 Volt and 3.8V power supply is based on the commercial 7805 & Lm317 voltage regulator IC. The LM35 series are precision integrated- circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature.

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Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm.. This buzzer can beused by simply powering it using a DC power supply ranging from 4V to 9V. A simple 9V battery can also be used but it is recommended to use a regulated +5V or +6V DC supply. The buzzer is normally associated with switching circuit to turn ON or OFF the buzzer at the required time and interval. ESP8266 is Wi-Fi enabled system on chip (SoC) module developed by Expressive system. It is mostly used for development of IoT (Internet of Things) embedded applications. To communicate with the ESP8266 module, microcontroller needs to use a set of AT commands. NodeMCU is an open-source LUA base- ed firmware developed for ESP8266 Wi-Fi chip. By exploring functionality with ESP8266 chip, NodeMCU firmware comes with ESP82- 66 Development board/kit also known as NodeMCU Development Board. NodeMCU Dev Kit/board consist of ESP8266 Wi-Fi enabled chip. The ESP8266 is a low-cost i-Fi chip developed by Expressive Systems with TCP/IP protocol. NodeMCU Dev Kit has Arduino like Analog (i.e., A0) and Digital (D0-D8) pins on its board. It supports serial communication protocols i.e., UART, SPI, I2C etc. A Pushbutton Switch is a switch designed so that its contacts are opened and closed by depressing and releasing a pushbutton on the Switch in the direction of its axis. Used in case of the emergency condition**.** The MAX30100 is an integrated pulse oximetry and heart rate monitor sensor solution. It combines two LEDs, a photodetector, optimized optics and low-noise analog signal processing to detect pulse oximetry and heart-rate signals. The MAX30100 operates from 1.8V and 3.3V power supplies and can be powered down through software with negligible standby current, permitting the power supply to remain connected at all times.As indicated, the GPS modules are based on the u-block NEO-6M GPS engine. Embedded C is one of the most commonly used Programming Languages in the development of Embedded Systems. Embedded C is perhaps the most popular languages among Embedded Programmers for programming Embedded Systems. There are many popular programming languages like Assembly, BASIC, C++ etc. that are often used for developing Embedded Systems. The Embedded C Programming Language has similarsyntax and semantics of the C Programming Language.

V. RESULT AND FUTURE ENHANCEMENT

A. Result

When the engineers will design a new product, they must study everything related to its idea to avoid errors and they must introduce high quality, low cost, high accuracy, small size and easy to use product, then they should take customers opinions and suggestions to improve their skills in the next design. Thus, this paper discusses the prospects for introducing a portable system for diagnosing COVID-19. A block diagram of the system is presented on the basis of a patient status sensor in combination with a portable computing device - a smartphone, tablet, etc. Such a structure will significantly reduce the cost of the device, which will contribute to its wider distribution. As the main method of state control, it is proposed to use the method of measuring the transmission coefficient of the microwave signal through the patient's chest. In this case, measurements are carried out at a single point, but for a long time, for example, when the device is continuously worn during the day. The advantages of using microwave technologies allow us to apply the proposed structure to monitor the condition of patients of all age groups, including young children. The integration of additional sensors for the patient's vital activity and the state of the environment, together with the use of modern IT technologies, will enable the creation of a comprehensive system for monitoring the patient's condition and informing him of the necessary actions in a timely manner.

B. Future Enhancement

In addition to this the future scope of this project is to develop smart band system based on IOT web-based server to save the data permanent and saved data can be used for predication of the COVID accuracy of the person.

1) The size of the band can be reduced.
2) Modified as a wearable glove for the hand.
3) Developed as a Smart Health Band which can be used to monitor vitals in daily life.
4) The values for the sensor can be changed to identify symptoms of other disease.

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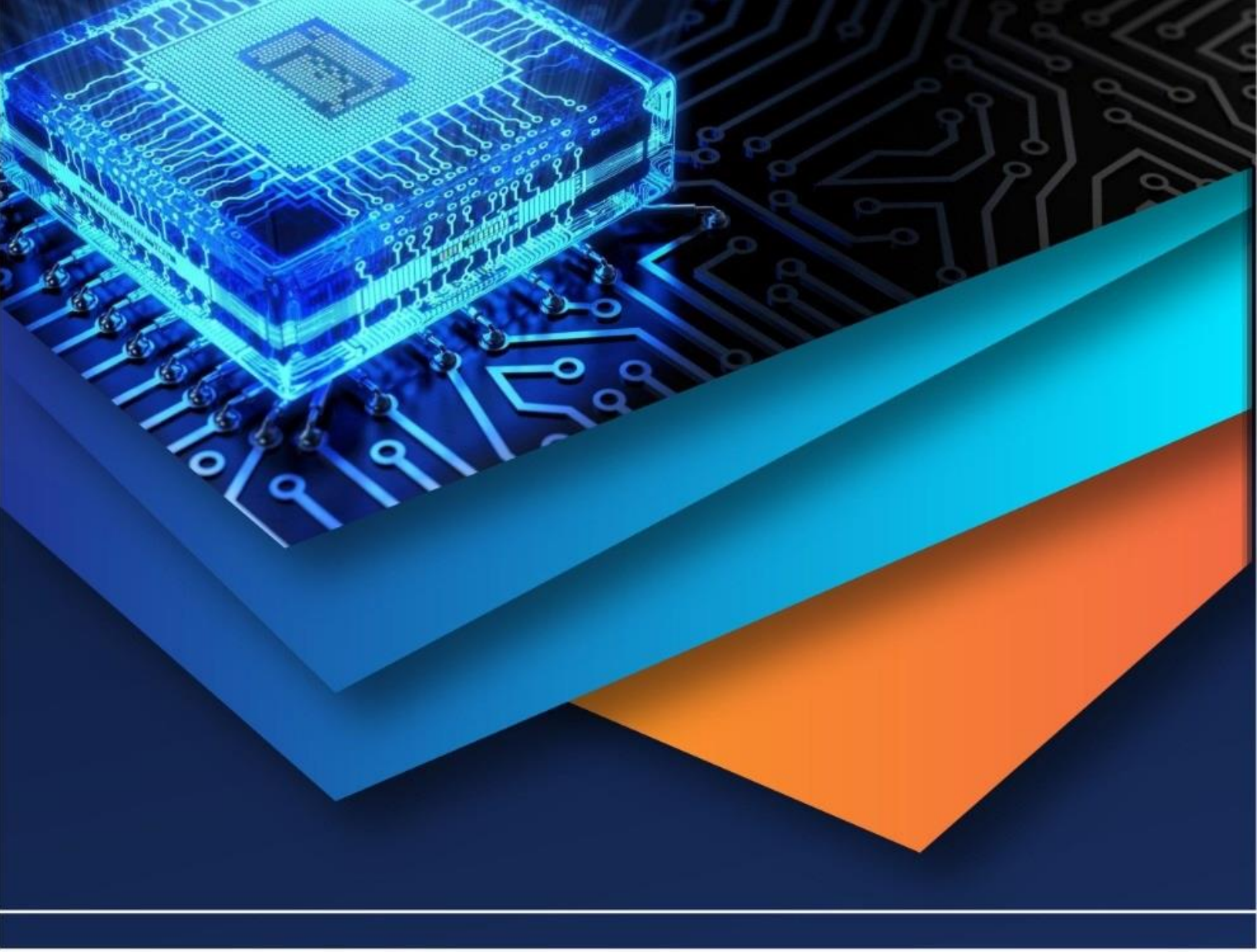

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