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Human Health Monitoring System Using IOT

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Abstract: ***With an improvement in technology and miniaturization of sensors, there have been attempts to utilize the new technology in various areas to improve the quality of human life. One main area of research that has seen an adoption of the technology is the healthcare sector. The people in need of healthcare services find it very expensive this is particularly true in developing countries. As a result, this project is an attempt to solve a healthcare problem currently society is facing. The main objective of the project was to design a remote healthcare system. It's comprised of three main parts. The first part being, detection of patient's vitals using sensors, second for sending data to cloud storage and the last part was providing the detected data for remote viewing. Remote viewing of the data enables a doctor or guardian to monitor a patient's health progress away from hospital premises.***

I. INTRODUCTION

A Human health monitoring system is an extension of a hospital medical system where a patient's vital body state can be monitored Humanly. Traditionally the detection systems were only found in hospitals and were characterized by huge and complex circuitry which required high power consumption. Continuous advances in the semiconductor technology industry have led to sensors and microcontrollers that are smaller in size, faster in operation, low in power consumption and affordable in cost.

A. Problem Statement

Human health monitoring can provide useful physiological information in the home. This monitoring is useful for elderly or chronically ill patients who would like to avoid a long hospital stay. Wireless sensors are used to collect and transmit signals of interest and a processor is programmed to receive and automatically analyze the sensor signals. In this project, you are to choose appropriate sensors according to what you would like to detect and design algorithms to realize your detection. Examples are the detection of a fall, monitoring cardiac signals.

Using a single parameter monitoring system an approach to a Human health monitoring system was designed that extends healthcare from the traditional clinic or hospital setting to the patient's home. The system was to collect a heartbeat detection system data, fall detection system data, temperature data and few other parameters. The data from the single parameter monitoring systems was then availed for Human detection.

During design the following characteristics of the future medical applications adhered:

1) Integration with current trends in medical practices and technology,
2) Real-time, long-term, Human monitoring, miniature, wearable sensors and long battery life of adesigned device

II. LITERATURE REVIEW

A. Human Health Monitoring System Using IOT

Nowadays, Heart-related diseases are on the rise. Cardiac arrest is quoted as the major contributor to the sudden and unexpected death rate in the modern stress filled lifestyle around the globe. A system that warns the person about the onset of the disease earlier automatically will be a boon to the society. This is achievable by deploying advances in wireless technology to the existing patient monitoring system. This paper proposes the development of a module that provides mobility to the doctor and the patient, by adopting a simple and popular technique, detecting the abnormalities in the bio signal of the patient in advance .Worldwide surveys conducted by World Health Organization (WHO) have confirmed that the heart-related diseases are on the rise. Many of the cardiac-related problems are attributed to the modern lifestyles, food habits, obesity, smoking, tobacco chewing and lack of physical exercises etc. The post-operative patients can develop complications once they are discharged from the hospital. In some patients, the cardiac problems may reoccur, when they start doing their routine work. Hence the ECG of such patients needs to be monitored for some time after their treatment.

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This helps in diagnosing the improper functioning ofthe heart and take precautions. Some of these lives can often be saved if acute care and cardiac surgery is provided within the so-called golden hour. So, the need for advice on first-hand medicalattention and promotion of good health by patient monitoring and follow-up becomes inevitable. Hence, patients who are at risk require that their cardiac health to be monitored frequently whether they are indoors or outdoors so that emergency treatment is possible. Telemedicine is widely considered to be part of the inevitable future of the modern practice of medicine.

III. SCHEMATICS

A. Block Diagram

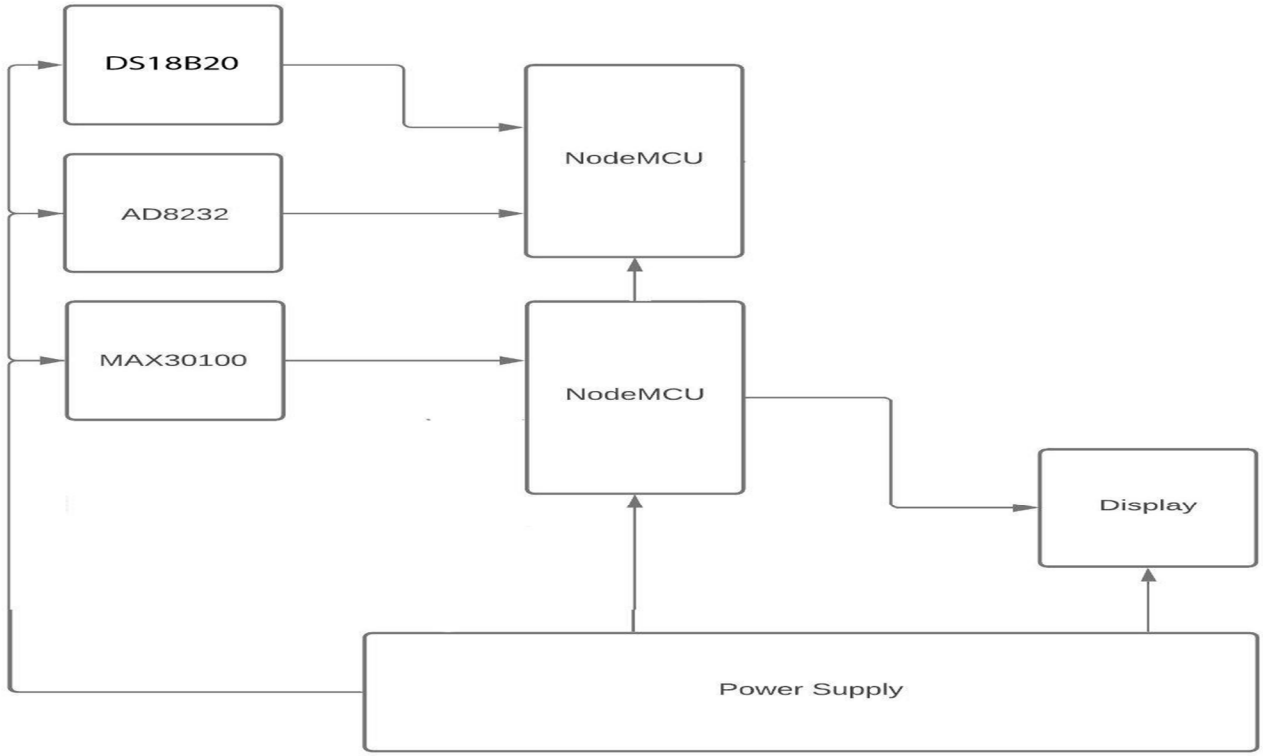

Fig 3.1 Block diagram

This Block diagram represents the Node MCU are connected to an web application and to the Mobile app. This health monitoring system consists of sensors and a microcontroller.
We usedthe NODE MCU as the microcontroller, and the sensors are MAX30100 (pulse rate and SPo2 measurement sensor) and LM35 (body temperature measurement sensor). To connect the NODE MCU with the mobile application and LCD display. All the needed components for the health monitoring system.

B. Software Requirements

Blynk Application. (Mobile software).

C. Hardware Requirements

Sensors and Modules
Proposed system consists of following sensors and modules

1) NODE Microcontroller unit.
2) Temperature Sensor.
3) Pulse Oximeter Sensor.
4) Electro Cardio Graph.
5) OLED Display (Organic Light Emitting Diode).

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IV. EXISTING SYSTEM

In the existing system, we use active network technology to network various sensors to a single PMS. Patients' various critical parameters are continuously monitored via single PMS and reported to the Doctors or Nurses in attendance for timely response in case of critical situations. The sensors are attached to the body of the patients without causing any discomfort to them. In this PMS we monitor the important physical parameters like body temperature, ECG, heart beat rate and blood pressure using the sensors which are readily available. Thus, the analog values that are sensed by the different sensors are then given to a microcontroller attached to it. The microcontroller processes these analog signal values of health parameters separately and converts it to digital values using ADC converter.

Now, the digitalized values from more than one microcontroller are sent to the Central PMS. Each of the sensors attached microcontroller with a transceiver will act as a module which has its own unique ID. Each module transmits the data wirelessly to the gateway attached to the PC of the Central PMS

The gateway is attached to the PC i.e. Central PMS which is situated in the medical center, is capable for selecting different patient IDs and allowing the gateway to receive different physical parameter values the patient specified by the ID .The software designed using Graphical User Interface (GUI) can operate on different physical parameters of each patient, consecutively with a specified time interval for each patient.

At any time, any of the doctors or nurses can log on the Central PMS and check the history of the observed critical parameters of any of the patient attached to the network.

A. Implementation

This project has been developed with NODE microcontroller Unit connected with sensors which are attached to the patient. All the sensors and data sent from microcontroller to MySQL database into the IOT. A doctor or guardian can log in to web portal to monitor patient's data at any point in time. In case of emergencies, like temperature spike or heartbeat spike or detection of toxic gas etc. At anytime can be checked by doctor and guardian's mobile or PC respectively. And at any point of time either a doctor or guardian can log into web portal with patient unique credentials and can track patient's location which would help medical services to send appropriate help in case of emergencies.

1) Hardware Specifications Sensors,

- Temperature Sensor (DS18B20)
- NODE Microcontroller Unit (ESP8266)
- Pulse Oximeter Sensor (MAX 30100)
- ECG-Electro Cardio Gram/Graphy (AD8232)
- OLED Display (Organic Light Emitting Diode) (SSD1306).

2) Software SpecificationsOS , Software's

- Blynk application Latest version
- Operating System: Windows 7 or higher
- Technologies used: C, SQL, PHP
- A good performing Smart phone.

B. System Design

Systems design is the process of defining the architecture, components, modules, interfaces, and data for a system to satisfy specified requirements. Overall product architecture, the subsystems that compose the product, and the way subsystems are allocated to processors are depicted using the System Design. UML is used to model system designs. Unified Modelling Language is a standard object-oriented analysis and design language. Use Case diagram and Sequence diagram, which are types of UML diagrams, of the application are shown below.

C. Working Principle

1) *Graphical User Interface:* This Project is designed to make sure that user interface pages are easily understandable and the navigation between pages is obvious. Below are list of web pages that user can navigate between and are shown in details.
2) *Web Application Login:* Here doctor or care taker enter patient's unique credentials. Once the credentials are verified, login page will be navigated to Patient vital monitoring page where doctor or caretaker can view current vital readings of the patient. Here patient's unique credentials must be kept confidential by the doctor and caretaker to protect privacy of the patient data.

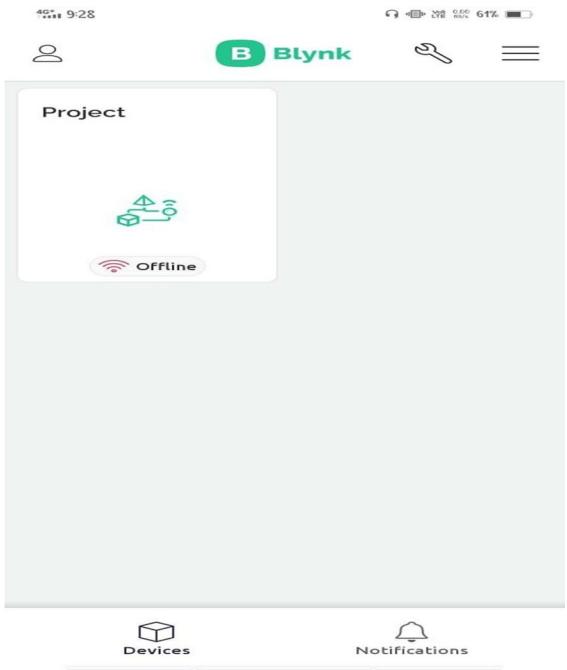

Fig 4.5.2 Uploading the project

D. Patient's Vital Monitoring Page

After doctor or care taker login successfully, either can able to view live patient's vital information which includes temperature, heartbeat, ECG etc. In order to protect privacy of thepatient's data, data is encrypted while sending it to MySQL database server and is decrypted while relaying same data on web page. In below images, it is shown in detail about that the current readings of the patient are displayed onpatient vital monitoring page with out any error. In case device is not connected or any of the sensor is not attached to patient, then all the readings or respective reading would be shown as zero in case of digital values. In case device is switched off then this page would display only last known readings that were stored in database.

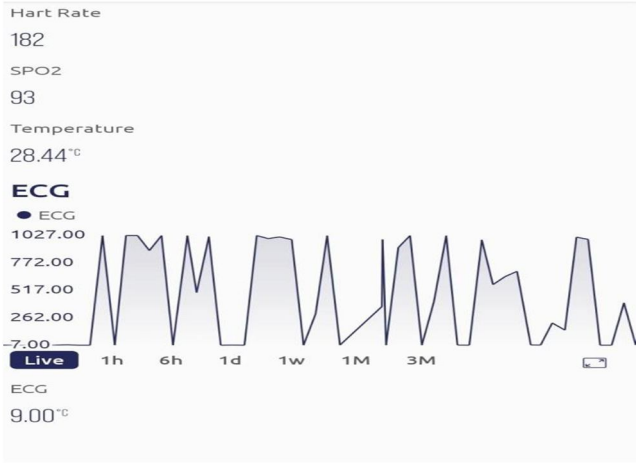

Fig 4.6 vitals of patient body

V. PROTOTYPE

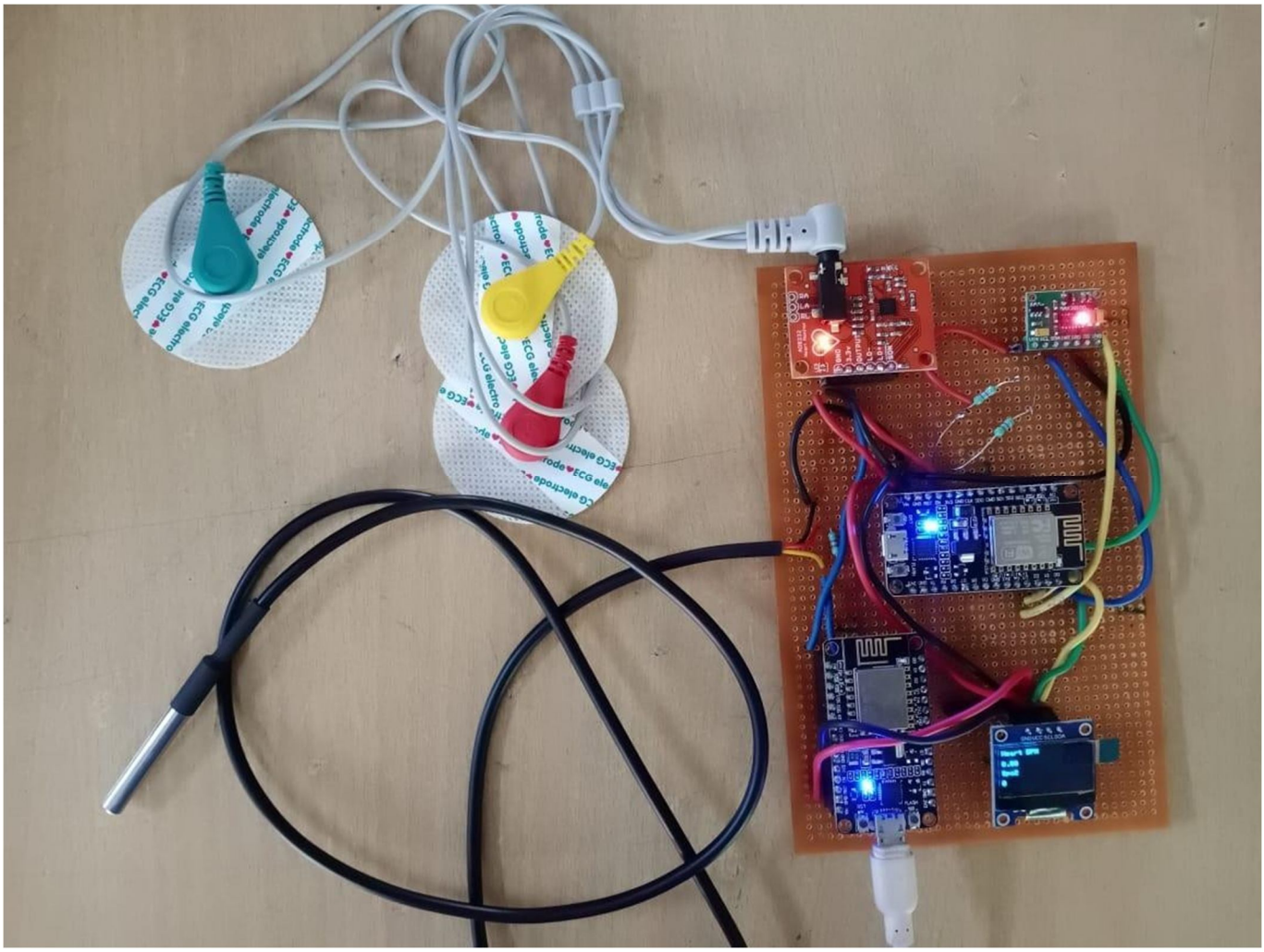

Fig 5.1 prototype kit

A. Performance Testing

Performance of the system can be determined based on the system/applicationresponsiveness under all kinds of load. Performance testing in IoT framework is little different thantraditional performance testing. IoT devices generates a lot of data which is saved in server and analyzed for immediate decisions. Hence IoT system must be built for high performance and scalability. And to measure these two key attributes, it is important to understand the business valuefor which it is build i.e. in our case patient health data. Hence it is necessary to simulate real worldmodels, network conditions etc.

Performance testing approach on IoT Framework	
Section	IoT PT
Simulation	On devices or sensors
Scale	Few devices to thousands of devices
Protocols	IoT uses non-standard and new protocols to communicate
Requests/Response	IoT devices create the requests and receive response aswell as request and provide response
Amount of data	Sends and receives minimal data per request but data isshared continuously with time interval

VI. SUMMARY OF THE STUDY AND CONCLUSION

A. Introduction

The Human patient monitoring system was researched, designed and presented the concept of the Internet of things. Personal physiological data from the patient is collected that simulates fall detection, heartbeat, temperature, pressure. The readings are collected in a simple cloud database and can be viewed Humanly by a doctor or Healthcare giver. The data can also be used in researchon medical issues affecting the elderly or chronically ill. On the security of the data, the database system is protected with Advanced Encryption Standard (AES). This generates the secret key whichcan be used to decrypt the patients' records ensuring that only authorized personnel access the data.This safeguards the patients' records from unauthorized users and hackers who may want to intercept.

B. Conclusion

The main objective of the experiment was successfully achieved. All the individual modules like Heartbeat detection module, fall detection module etc. and Human viewing module gave out the intended results.

The designed system modules can further be optimized and produced to a final single circuit. More important fact that came up during project design is that all the circuit components used in the Human health detection system are available easily.

With the development in the integrated circuit industry, Micro Electro Mechanical Systems (MEMs)and microcontrollers have become affordable, have increased processing speeds, miniaturized and power efficient. This has led to increased development of embedded systems that the healthcare specialists are adopting. These embedded systems have also been adopted in the Smartphone technology. And with increased internet penetration in most developing countries through mobile phones, and with use of Internetof things (IoT) will become adopted at a faster rate. The Human Health Care system utilizes these conceptsto come up with a system for better quality of life for people in society. From an engineering perspective, the project has seen concepts acquired through the computer science and embedded study period being practically applied. The Electric circuit analysis knowledge wasused during design and fabrication of the individual modules.

Electromagnetic fields analysis used in the wireless transmission between microcontrollers and Software programming used during programming of the microcontrollers to come up with a final finished circuit system.

C. Future Work

1) Physiological data collection
2) Home Ultrasound
3) Brain signal monitoring
4) Remote viewing of data
5) Problems associated with having data online. Tackle Distributed denial of service. DDOS, and Data privacy/security especially of medical systems.
6) IoT based Remote Patient Monitoring System can be enhanced to detect and collect data of several anomalies for monitoring purpose such as home ultrasound, Brain signal monitoring, Tumor detection etc.
7) More research on problems associated with having data online, data privacy as IoT is managed and runby multiple technologies and multiple vendors are involved in it. Security algorithms and certain precautions by the users will help avoid any security related threats in IoT network.
8) The interface can be designed to control which sensors can be used by consumers according to their needs.

Web UI can be enhanced to perform several activities which include controlling the hardware, real-time graphs, history and analysis graphs to observe anomalies etc.

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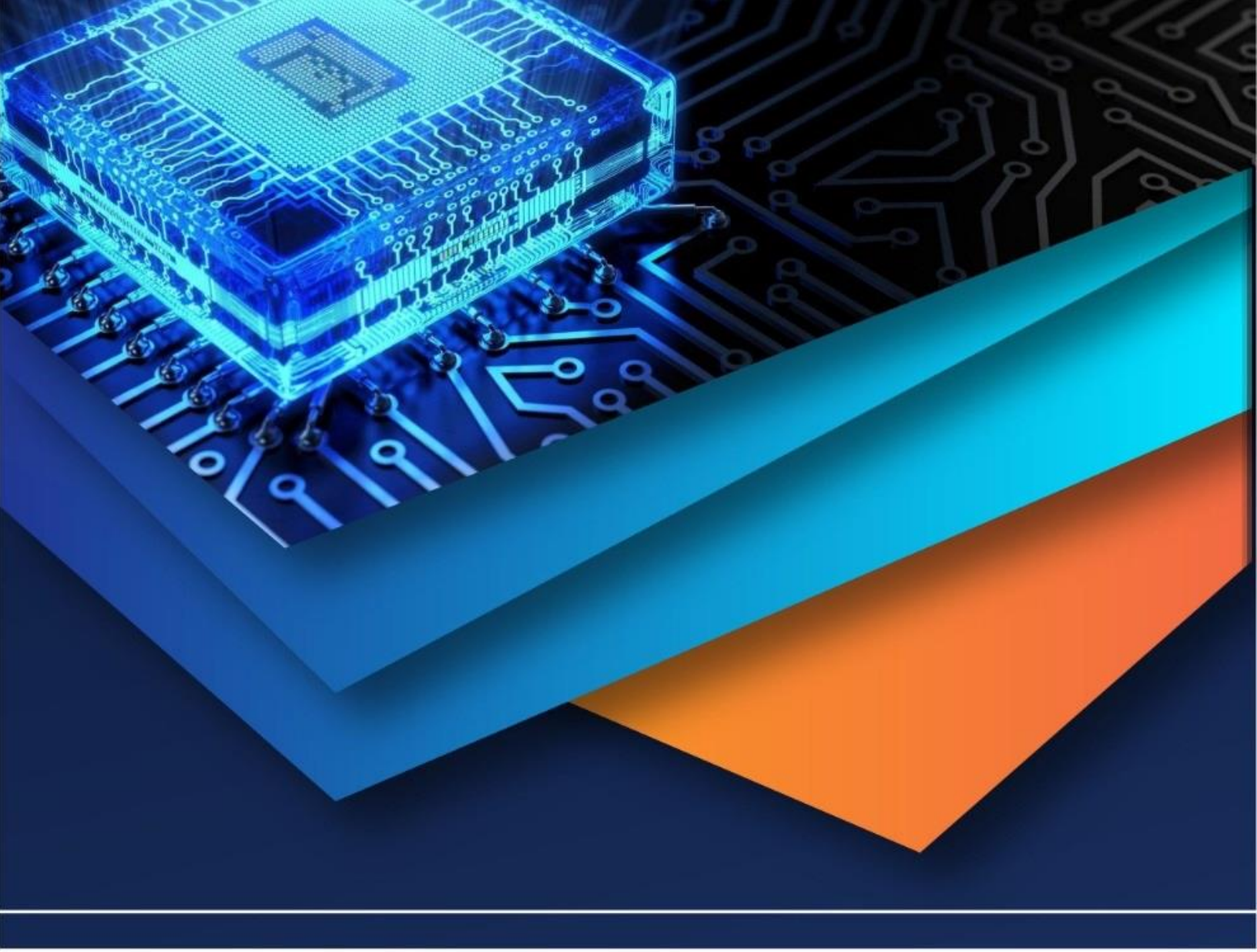

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