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IOT Enabled Wearable Gloves with SEMG Subsystem with Posture Analysis

Swathi Sangaboina[1], Dr. P. Sudhakar Rao[2]
[1]*MTech Student in ECE Department of G. Narayanamma Institute of Technology & Science (For Women) Shaikpet, Hyderabad, Telangana, India-500104*
[2]*DEAN & Professor in ECE Department of G. Narayanamma Institute of Technology & Science (For Women) Shaikpet, Hyderabad, Telangana, India-500104*

Abstract: ***Electromyogram (EMG) is a technique to track the record , analyze and estimate the electrical activity produced by muscles. This technique is used to detect the muscle issues that harm the nerves activity , muscle tissues and identify the location where they are joined together . This paper discusses the implementation of a project which can be considered as a tool for the acquisition of muscle activity, presentation and real-time attainment of EMG signal using a specific EMG sensor. The live EMG reading is recorded using the Wi-Fi- enabled Raspberrypi and then sent to a remote server in our case ThingSpeak server with the help of IoT concepts which helps in the telemetry of the obtained biomedical signals using the cloud. Results are displayed in ThingSpeak. The live recordings are also obtained on the PC using the serial plotter. This project can also help us in monitor and observe the progress of the patient treatment even if the physiotherapist could not come and data can be directly sent to them. Thus, the project aims to develop an EMG monitoring device based on IoT, for analyzing and acquiring EMG signals.***

Keywords: EMG sensor, Raspberry pi, LCD, ADS1115

I. INTRODUCTION

EMG is defined as electromyography. It is used to report the muscle activity of electrical signals. Electromyography may also term to be activity of myoelectric. The tissue of muscle behaviors electrical potentials of human body same way like what nerves do and produce electric activity of the muscle tissue and given title to the electrical signals is the moment of muscle ability. Electromyography (EMG) is a different technique for specifying muscle pulse activation. The area of EMG pattern reorganization and interpretation of bio signals have becoming fast popularity during the past few years. This type of research represents a smooth path to interface with the neuromuscular to identify handicapped people with the outer world. Human body generates electric signals using these signals the external device to be controlled. This process also defined as to be MyoElectric Control (MEC).

EMG signal is the vital technique for evaluation of bio-signals which are generated by the human body, It defines the muscles activity or summation of various motor units action potentials. These signals have the properties of nonlinear, non-stationary, large variation and complexity. The Mio-Electric Signal (MES) is different signal that are controlled by the central nervous system (CNS). It is caused due to the functional behavior and physical muscle positions of human body, the EMG system of the peripheral nervous system and the specifications of the instrumentation are supportive to trace and measure these signals. EMG signal is normally a time function also it is indicated in terms of the parameters like frequency, amplitude and phase. EMG signal also measures and identifies electrical impulses produced in muscles tissue at the time of its activities of neuromuscular in human body. These electrical impulses area also called as action potentials which are the main cause for contraction of muscles. The electrodes positioned at the base of the skin above a muscle can detect these kind of moment potential mutually, which is addressed as EMG.

II. BLOCK DIAGRAM

Physical depictures are directly connected with human body strength and fitness. To extract real-time health monitoring system for computing, analyzing measurements of bio signals like electromyography (EMG) and electrocardiogram, In order In order to obtain exact data to attain enhanced health-care systems in terms of diagnosis, treatment. and observation the hardware has the capacity of getting better results and constantly transfer the information wireless at a high transmission rate in real-time to cloud.

Initially user has to place the electrode to the EMG sensor so that we can simply tie the electrodes on to the sensor panel Initially choose a muscle group.

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Rubber the skin properly before placing the electrodes the muscle tissue if you want to know the EMG reading. User can also use rubbing alcohol and a piece of cotton, later you can eliminate unwanted the back seal of the electrodes and place the sensor in a position that any of the integrated electrodes comes in contact with the center of the group of muscle and the other combines with the rear end of group of muscle. The user has to position the reference electrode on a softer end and Connect electric muscle Sensor to raspberry pi. ADS1115 converter is used to convert analog to digital data. ADS1115 are simple to use with raspberry pi using I2C communication bus ADS1115 is a higher accuracy with 16 bit ADC which contains 4 channels

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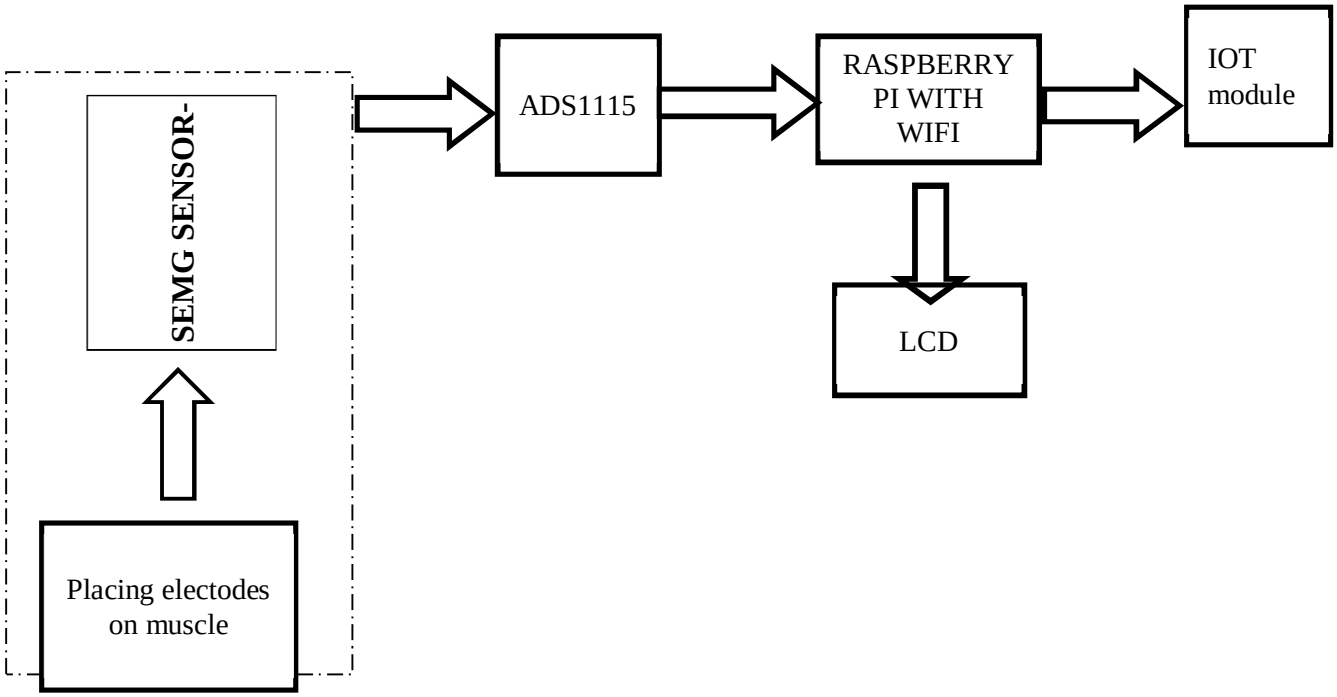

Fig 1. Block Diagram

III. SYSTEM IMPLEMENTATION

Initially, the electrodes are placed on the muscles and the signals are collected using the surface electrodes and EMG sensor. Then the signal goes to ads115 to convert analog to digital data which helps in monitoring and analysis. The EMG readings are collected using the Computer for viewing in the form of graphs and these graphs are obtained with the help of raspberrypi. The signal processed and further it can be analyzed and stored in the cloud for the purpose of communication and graph can be observed using ThingSpeak. interfacing of any sensor which gives analog voltage output with raspberry pi which requires an external ADC is used to take the data samples.

Raspberry pi does not have on chip ADC to convert analog values into digital values here we are using ADS115 to convert output as digital valuesADS115 provides I2c interface to interact with raspberry piADS115 is a four channel ADC uses I2c with raspberry pi. It utilizes I2C protocol with selectable addresses. In future if the user have to connect the ADC to raspberry Pi conform that to enable I2C on the raspberry pi using raspi-configuration Don't look forward until when I2C is enabled and you have tested the ADC and observed in order to detect command line of I2cc and Connect the ADC to the raspberry Pi below defines pin connection of raspberry pi and ADC :

1) Integrate ADS1115 VDD pin to Raspberry Pi 3.3V
2) Integrate ADS1115 Ground pin to Raspberry Pi GND
3) Integrate ADS1115 Serial clock pin to Raspberry Pi Serial clock pin
4) Integrate ADS1115 serial data pin to Raspberry Pi Serial data pin

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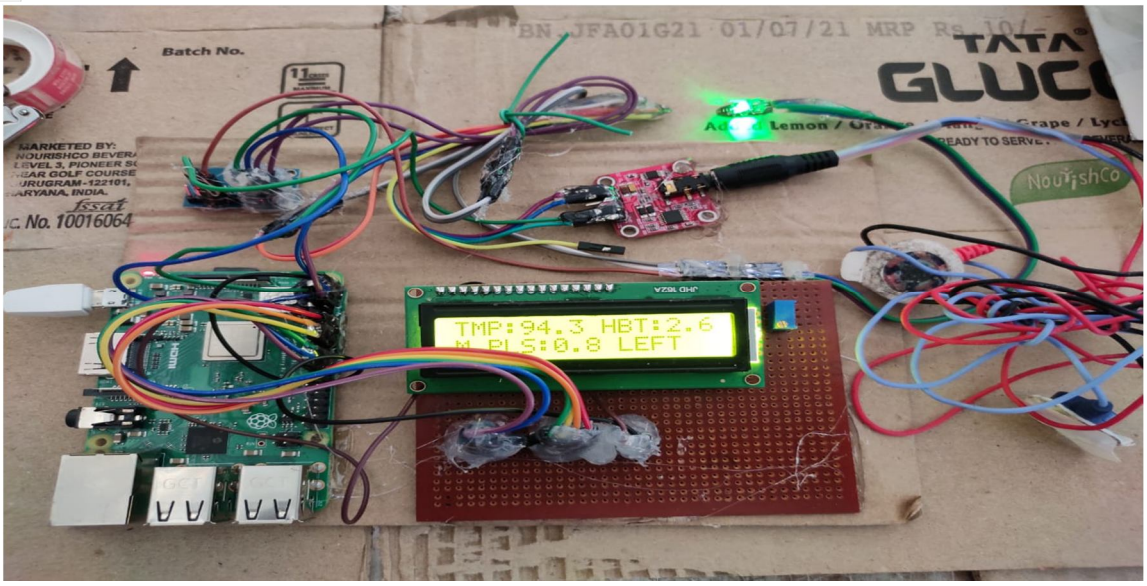

Fig 2. Interfacing of emg sensor with raspberry pi

IV. RESULTS

Physical depictures are directly connected with human body strength and fitness. To extract real-time health monitoring system for computing, analyzing measurements of bio signals like electromyography (EMG) and electrocardiogram, In order In order to obtain exact data to attain enhanced health-care systems in terms of diagnosis, treatment. and observation the hardware has the capacity of getting better results and constantly transfer the information wireless at a high transmission rate in real-time to cloud.

Here Programming language used to code the device is python, initially the user has to install some of the supporting libraries or packages, if necessary libraries are not downloaded then it results in compilation errors. In order to avoid such problems, select sketch and opt include library option. The below Fig 9 represents terminal window of raspberry pi certain values are obtained when an electrodes is placed on muscle tissue and that output values are loaded in thing speak and also displayed on LCD.

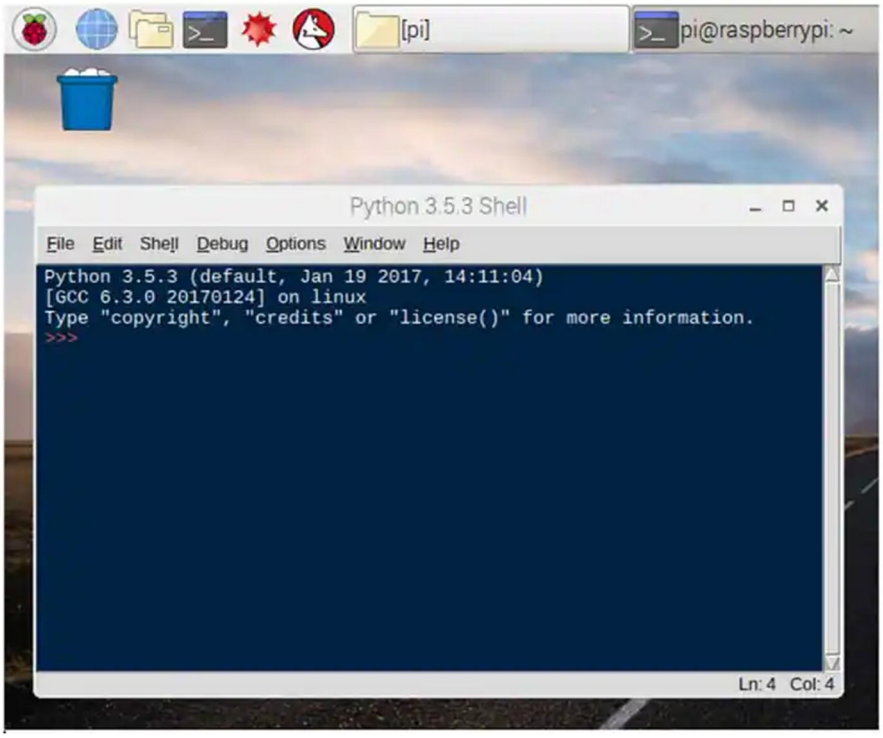

Fig 3. Terminal Window of raspberry pi

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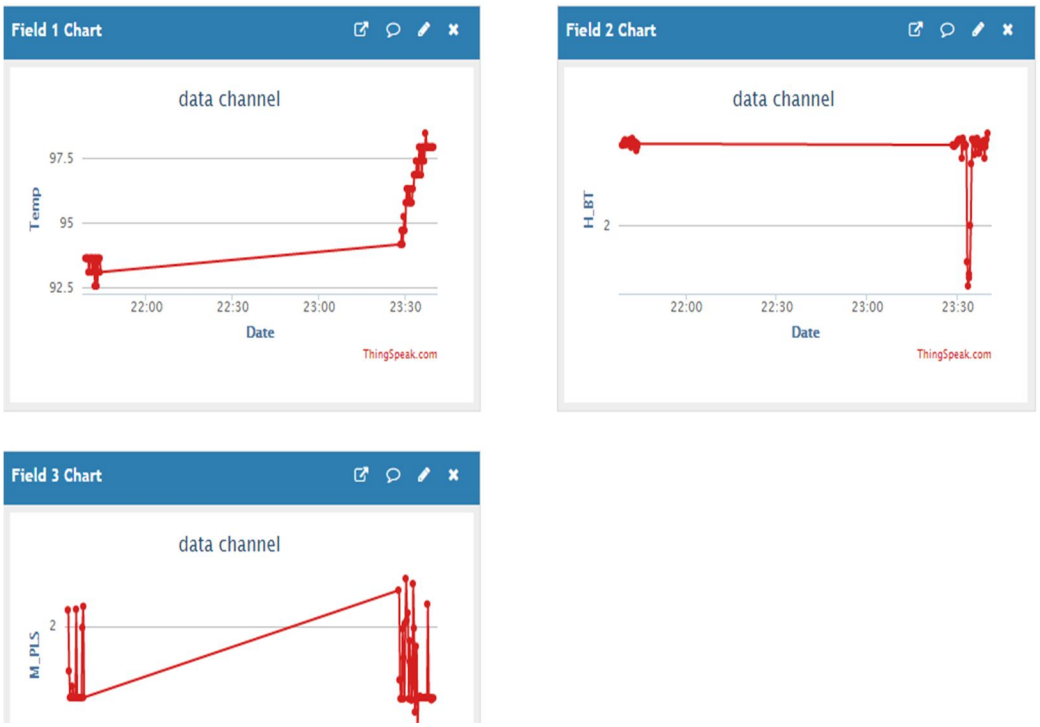

Fig 4 Field Chart

Thing Speak is also defined as IoT computational analysis of cloud platform resource that permits you to visualize and analyzse and collection of live data into cloud. Thing Speak also provides live vision of data By using raspberry pi it uploads sensor data to cloud automatically.It often used for prototyping and proof of concept IoT systems are that required for analytics. Uploading sensor data is done using Internet by connecting wifi . It is three step process. Having wifi hotspot having internet access.Connect to your WIFI hot spot having internet access

Fig 5: Communication process

Initially, the electrodes are placed on the muscles and the signals are collected using the surface electrodes and EMG sensor. Then the signal goes to ADS1115 Converter which helps to convert analog to digital data . The EMG readings are collected using the Computer for viewing in the form of graphs and these graphs are obtained with the help of raspberry pi. Here output of signal is then managed further and it can be stored in the cloud for the measurements for further analysis and graph views can be achieved using ThingSpeak.

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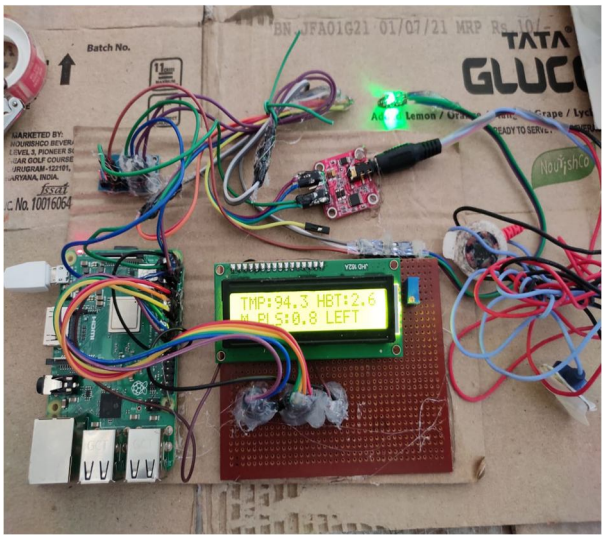

Fig 6 : Final output

Table 1. Values of EMG SENSOR connecting to controller

S.NO	POSITIONS	SENSOR	OUTOUT
1	Extend Out-g	913	227
2	Extend Out	912	227
3	Finger Scissor	922	229
4	Finger Opposition-g	916	228
5	Finger Hook	928	231
6	Finger Hook-g	911	227
7	Finger Opposition	923	229
8	Finger Pinch	927	230
9	Finger Pinch-g	924	230
10	Agree	928	231
11	Agree_G	928	227
12	Pen Spin	900	210
13	Pinch & Release	905	212
14	Pin Spin-g	910	220
15	Pinch & Release-g	943	234

Additionally, the IoT implementation also sends the local EMG data readings to the ThingSpeak server which could be monitored from anywhere in the world. This project opens the areas of real-time acquisition and real-time processing of EMG data. This project can also help us in monitoring the progress of the patient treatment even though if the physiotherapist could not come and data can be directly sent to them for further analysing. That data which in being sent to the doctor is being sent to the cloud as well which in-turn helps in the later stages. Thus, the aim to develop an EMG monitoring system based on IoT for analysing EMG signals can be well established here. Also since the information is stored in the cloud, that information can be accessed at any instant of time and from anywhere in the world.

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Fig 6 : EMG Monitoring Signal displayed on the ThingSpeak

V. CONCLUSION

This work explains the implementation of IoT based real time of EMG sensor data using the EMG sensor and Raspberry pi . The project implements a very cost-effective biomedical system using the Raspberry pi and required hardware.Additionally, the IoT implementation also sends the local EMG data readings to the ThingSpeak server which it could be observed from anyplace in the world. This project opens the areas of real-time acquisition and real-time processing of EMG data. Here this project may help us to observe and monitoring the current situation of the patient treatment even though the physiotherapist may not be come and data can be directly sent to them for further analysing. That data which in being sent to the doctor is being sent to the cloud as well which in-turn helps in the later stages. Thus, the aim to develop an EMG monitoring system based on IoT for analysing EMG signals can be well established here. Also since the information is stored in the cloud, that information can be accessed at any instant of time and from anywhere in the world .With the availability of the future applications of it like myo-arm band and the gaming facilities using computing system and developed applications like joy-sticks they have added importance in the upcoming and the future generations.

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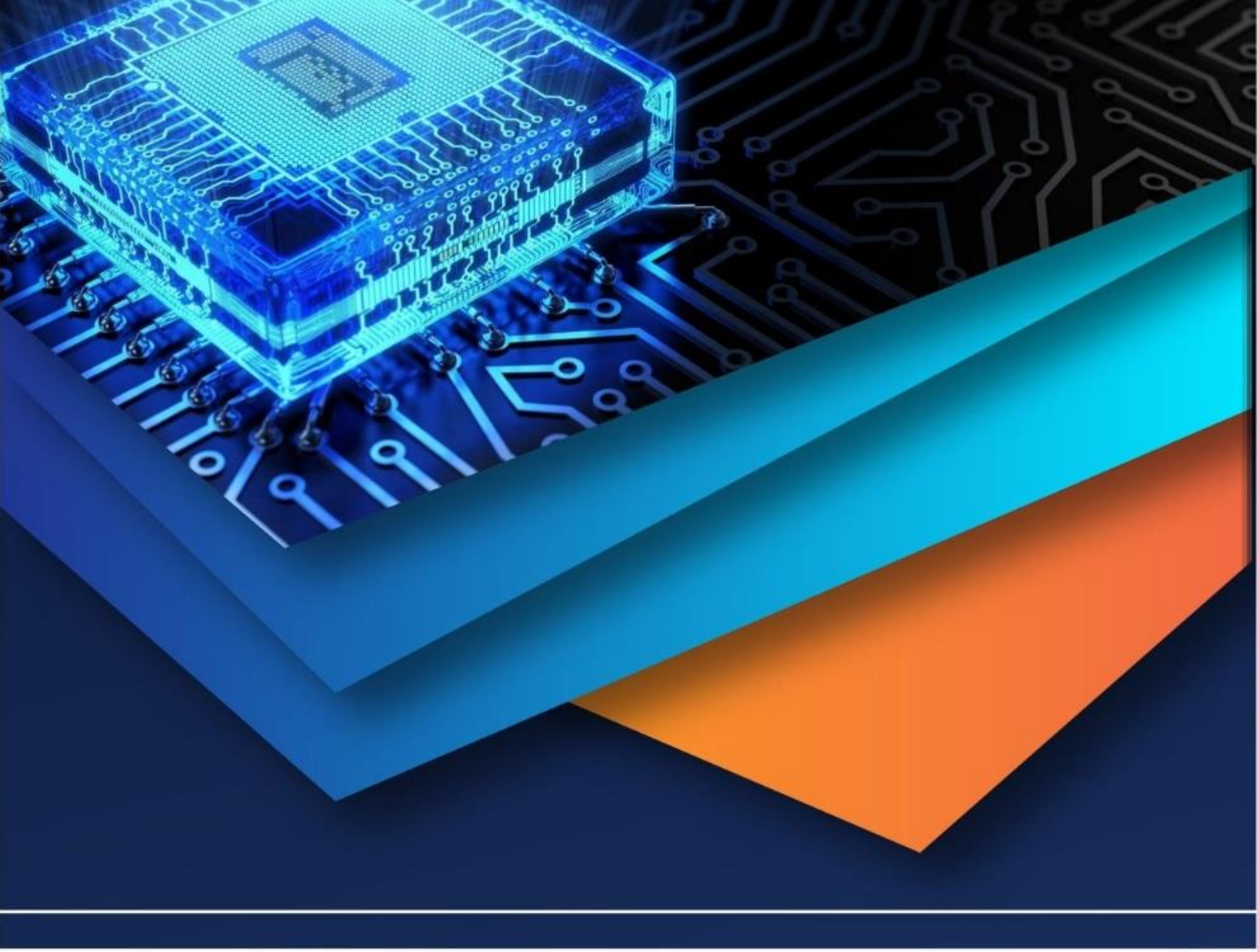

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