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Industrial Boiler Temperature Monitoring and Control using System DAQ and LabVIEW

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***Abstract:** Automation plays a major role in oil industry. The main advantage of automation is to increase productivity and reduces human error. This work involves monitor and controls the boiler temperature with controlling boiler system using DAQ and GSM. DAQ receiving temperature value from LM35 sensor. Boiler temperature across the cut- off range, immediately activate the cooling system and across the maximum range of temperature value message send to concern person. As well as the alarm on for safety purpose. This proposed system will maintain temperature value for oil industry.*
***Keywords:** LabVIEW, DAQ, LM35 Temperature sensors, Buzzer, Cooling fan*

I. INTRODUCTION

A personal computer (PC) based data acquisition; monitoring and control systems are gaining importance these days. Due to the flexibility offered by various platforms in practice. LabVIEW has been used successfully, served the purpose for many years in test and measurement applications due to the ease of graphical programming and its wide area of functionality for interfacing directly to instruments, sensors, and actuators [1].A trend is emerging for monitoring and controlling processes using virtual instrumentation. LabVIEW is one such software platform where virtual instrumentation can be realized. Here application implementation of temperature monitoring and control systems using LabVIEW is designed. The platform is basically on several tools which are developed by using the LabVIEW software. This system connects temperature sensors to a computer through DAQ [2]. The Virtual Instrument Software Architecture (**VISA**) is a standard for configuring, programming, and troubleshooting instrumentation systems comprising GPIB, VXI, PXI, Serial, Ethernet, and/or USB interfaces. NI-VISA is standard across the National Instruments product line DAQ card the system cost is effectively reduced [3]. The LM35 Temperature sensor series are precision integration circuit temperature device with an output voltage linearly proportional to the centigrade temperature. The operating temperature range is from -55°C to 150°C [4]. GSM plays a key role in transmitting and receiving data from the user. This paper is dedicated to this problem. This GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number. The main advantage of this concept is the real-time direct measurement of the parameter through the GSM technique. The stoppage and some accidents caused by increased temperature can be avoided. The self-designed GSM module is selected to finish the transmission and decoding of the data through **"AT"** command and coding of short PDU (Protocol Data Unit). Here the temperature is monitored directly which can be sent as a message by GSM technique. Applications like SMS Control, data transfer, remote control and logging can be developed easily [5].

II. RELATED WORK

LabVIEW has been used successfully served the purpose for many years in test and measurement applications due to the ease of graphical programming and its wide area of functionality for interfacing directly to instruments, sensors and actuators [1]. There is one care unit where a database of patient information is maintained and vital bio-signals such as body temperature and is monitored using sensors, DAQ and LabVIEW [6]. Normally, an automated system improves the system efficiency, plant monitoring, productivity and the operation management of the plant. The main objective of system is to give the means to the human operator to control and to command a highly automated process [3]. This paper is dedicated to this problem. There is one care unit where a database of patient information is maintained and vital bio-signals such as body temperature and is monitored using sensors, DAQ and LabVIEW [4]. Nowadays, Automation is not hard but advanced technique in home automation is required. Automation systems can control home equipment such as TVs, Fan, Tube lights. Android smart phones is done very important role in most of the systems. In wireless technology Bluetooth is used widely [5]. Main purpose of home automation is "SAVE ELECTRICITY". In daily routine life sufficient use of electricity is very important. Everyone can control the home equipment or office equipment automatically. Introduction of several wireless communication such as GSM [7].Consider revising medium temperature used LM35

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temperature sensor, what is an economic and feasible method. This study mainly researches the applicability of LM35 temperature sensor in soil temperature testing field [2]. If there is deviation in any of the parameters the system acts Immediately and forms a SMS that is automatically transmitted via GSM modem to the authorized persons also the transformer is disconnected from the source [8]. The proposed WSN system will be able to communicate each other with lower power consumption in order to deliver their real data collected to the farmer's mobile via GSM technology and to actuate the water sprinklers during the period of water scarcity [9]. The rapid development in telecommunication and wireless technologies, it is proved that wireless communication has good practice for remote sensing in the agriculture industries. In this paper uses wireless sensor network, Global System for Mobile Communication (GSM) and short message service (SMS) to carry out data from the green house with sensors directly alert the farmers to their mobile phone.

III. METHOROLOGY

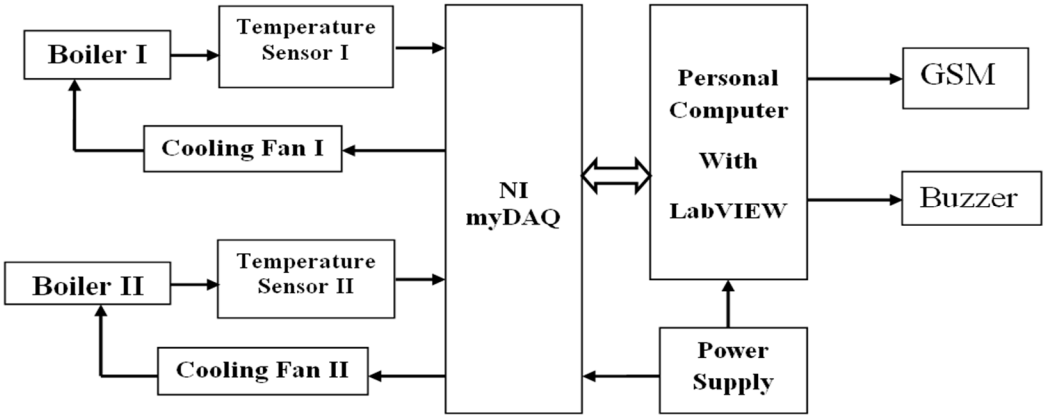


Figure.1. Block diagram

A. LabVIEW

Laboratory virtual instrument engineering workbench is a system- design platform and development environment for a visual programming language from national instruments. In which program is done in graphical from. It is used to test, measure and design. LabVIEW consist of two windows front panel and block diagram. Front panel is the window through which user interact with a program. Block diagram window holds the graphical source code of LabVIEW VI.

B. LM35 Temperature Sensor

In our proposed design we are using two sensors LM35. For analyzing the data graphically we use LabVIEW software and for transmitting data we use GSM technology. To measure the boiler temperature we LM35 sensor.LM35 sensor measure temperature more accurate than a using a thermister since it is industrial temperature sensor. It generate higher output voltage than thermocouple so no need to amplify the output voltage. The output voltage is directly proportional to the Celsius temperature. The scale factor is 0.1v/oc. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1⁄4°C at room temperature and ±3⁄4°C over a full −55 to +150°C temperature range. The range of this sensor is -550 C to 1500C. It is low cost and easily available sensor. It has also low self heating. LM35 has three terminal VCC, GND, and O/P.

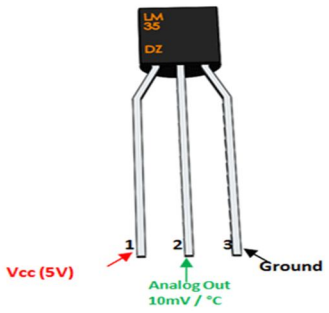


Figure. 2. LM35 Temperature sensor

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C. GSM/GPRS

GSM modem RS232 is built with dual band. GSM/GPRS engine –800L, Works on frequencies 850- 1900MHZ .The modem coming with RS232 interface, which allows you connect **PC** as well as LabVIEW with **RS232**. The baud rate is configuration from 9600- 115200 through AT command. The **GSM/GPRS** modem is having internal **TCP/IP** stack to enable you to connect with internal via GPRS. It suitable for SMS, voice as well as data transfer. The onboard Regulated Power supply allows you to connect wide range unregulated power supply. Using this modem, you can make audio calls, SMS, Read SMS; attend the incoming calls and internet est. through simple AT commands.

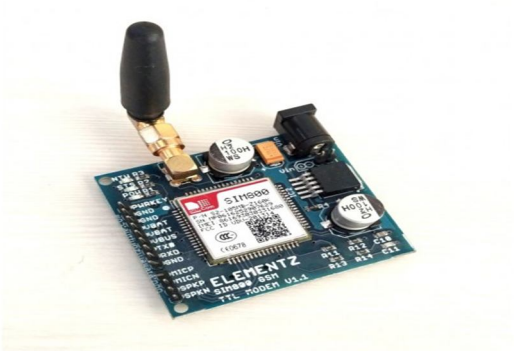


Figure3. GSM Module

1) Specification

a) Power ON reset switch.
b) Sliding SIM holder.
c) Network, Power and Status indicator.
d) MIC and Speaker Socket.
e) Power supply 12V/2A

D. DAQ using Serial Port

The goal of this application is to demonstrate the usefulness of multifunction data acquisition boards for monitoring and control. This is achieved by using the LabVIEW environment to acquire and process signals, generating commands and the process variables to the user. Serial communication needs specification of four parameters: the baud rate of the transmission, the data bits encoding a character, the sense of the optional parity bit, and the number of stop bits. Each transmitted character is packaged in a character frame that consists of a single start bit followed by the data bits, the optional parity bit, and the stop bit or bits. Baud rate is a measure of how fast data is moving between instruments that use serial communication. RS-232 uses only two voltage states. 58The baud rate is identical to the maximum number of bits of information, including "control" bits, which are transmitted per second. Serial communication uses a transmitter to send data, one bit at a time, over a single communication line to a receiver. We can use this method when data transfer rates are low.

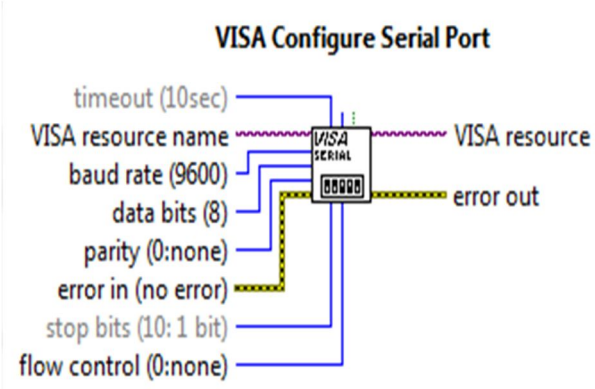


Figure. 4. VISA serial communication

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E. Cooling Fan

A 5V DC fan was used to demonstrate the output of the control system. As processors, graphics cards, RAM and other components in computers have increased in speed and power consumption, the amount of heat produced by these components as a side effect of normal operation has also increased. These components need to be kept within a specified temperature range to prevent overheating, instability, malfunction and damage leading to a shortened component lifespan. After it receiving input signal from the LM35 Temperature sensor it give the output to the cooling fan. The fan positive terminal is wired and connected to the LM35 [1] pin 1 to connect 5V power supply. Fan negative terminal connected [in] LM35 [2] 5V power supply.



Figure.5. Cooling fan

F. Buzzer

The buzzer is used to convert electrical signal into sound just like a speaker. The typical user of buzzer and beeps include alarm, devices, timer and confirmation of user input such as a mouse click or keystroke. A **buzzer** is a small yet efficient component to add sound features to our project/system. It is very small and compact 2-pin structure hence can be easily used on breadboard.

1) Specification

a) Rated voltage : 6V DC
b) Operating voltage: 4- 8V DC
c) Rated current : <30Ma
d) Sound type : continues beep



Figure.6: Buzzer

IV. RESUT AND DISCUSSION

The first step in this section is the programming of the LabVIEW Virtual Instrument (VI) to sample the temperature from the construction circuit divider and convert it into a temperature reading in real time. A VI consists of a front panel, block diagram, and an icon that represents the program. The front panel is used to display controls and indicators for the user, and the block diagram contains the code for the VI. The icon, which is a visual representation of the VI, has connectors for program inputs and outputs. Boiler when reaches the cut-off range temperature 32˚C it collects the data using DAQ and send the value to the program loaded in personal computer **(PC).** From LabVIEW it sends the alert message to the user through GSM module. And also it gives the alert sound through Buzzer. Automatically the cooling fan is on. Boiler when reaches the minimum range temperature 30˚C it collects the data using DAQ and send the value to the program loaded in personal computer **(PC).** From LabVIEW it sends the alert message to the user through GSM module. And also it gives the alert sound through Buzzer. Automatically the cooling fan is off.

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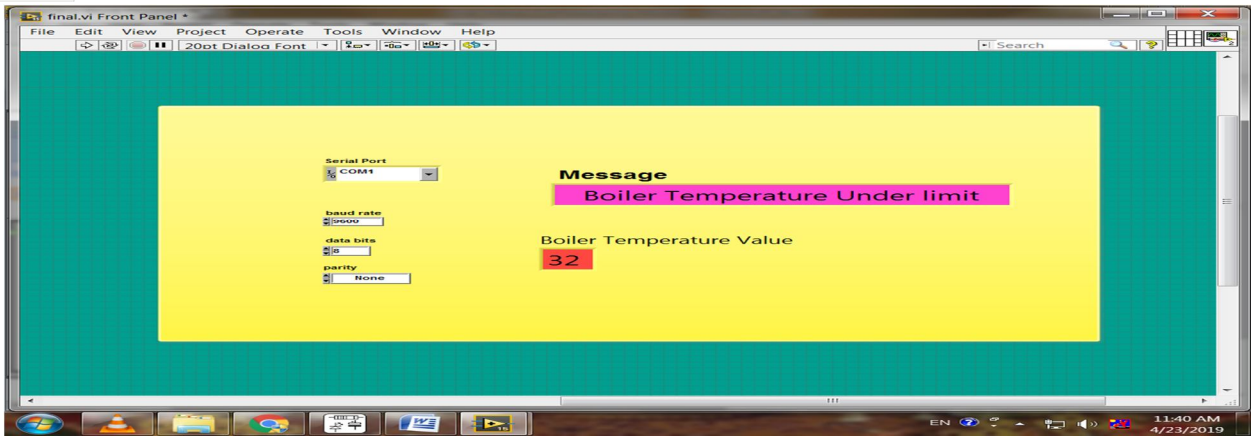


Figure 7.front panel (window)

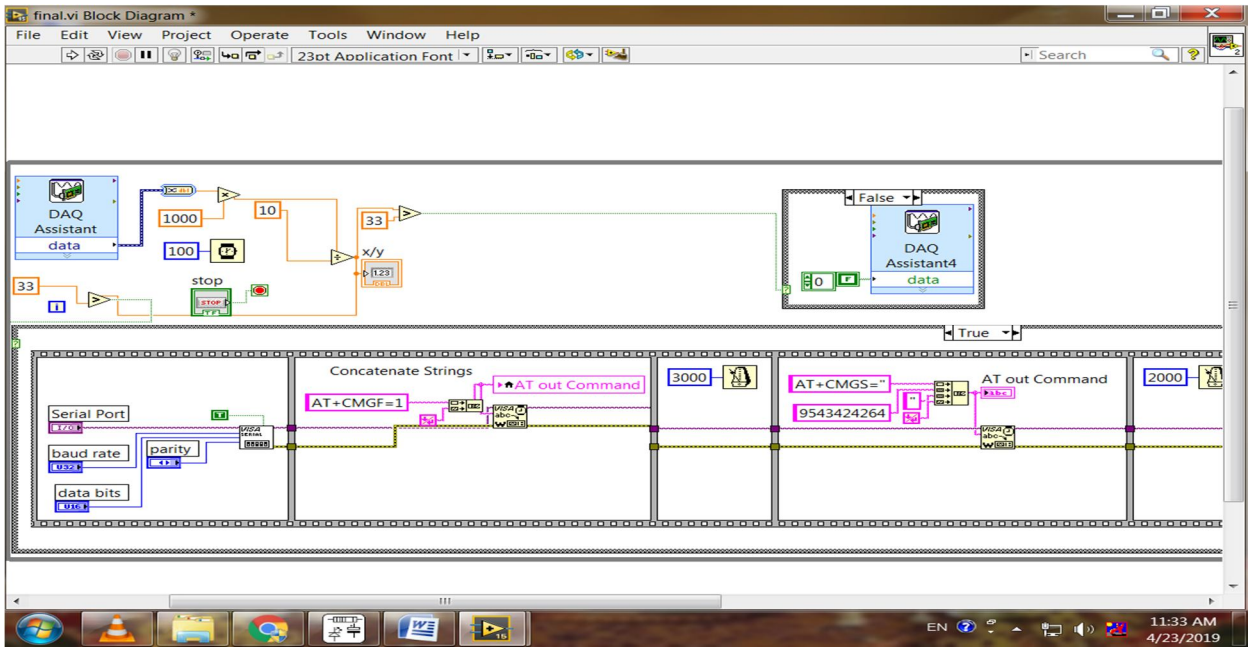


Figure 8. Block diagram (window)

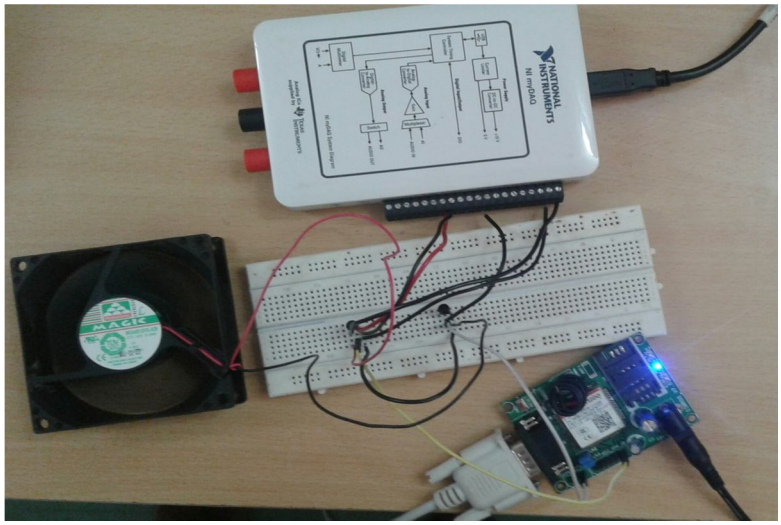


Figure 8. Hardware setup

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V. CONCLUSION

The project is designed for automatic control to regulate the boiler temperature and the input is given to LabVIEW and program and through DAQ. This is indicated by a system of buzzer and GSM message which is used as an alert signal for cut-off temperature and minimum temperature.

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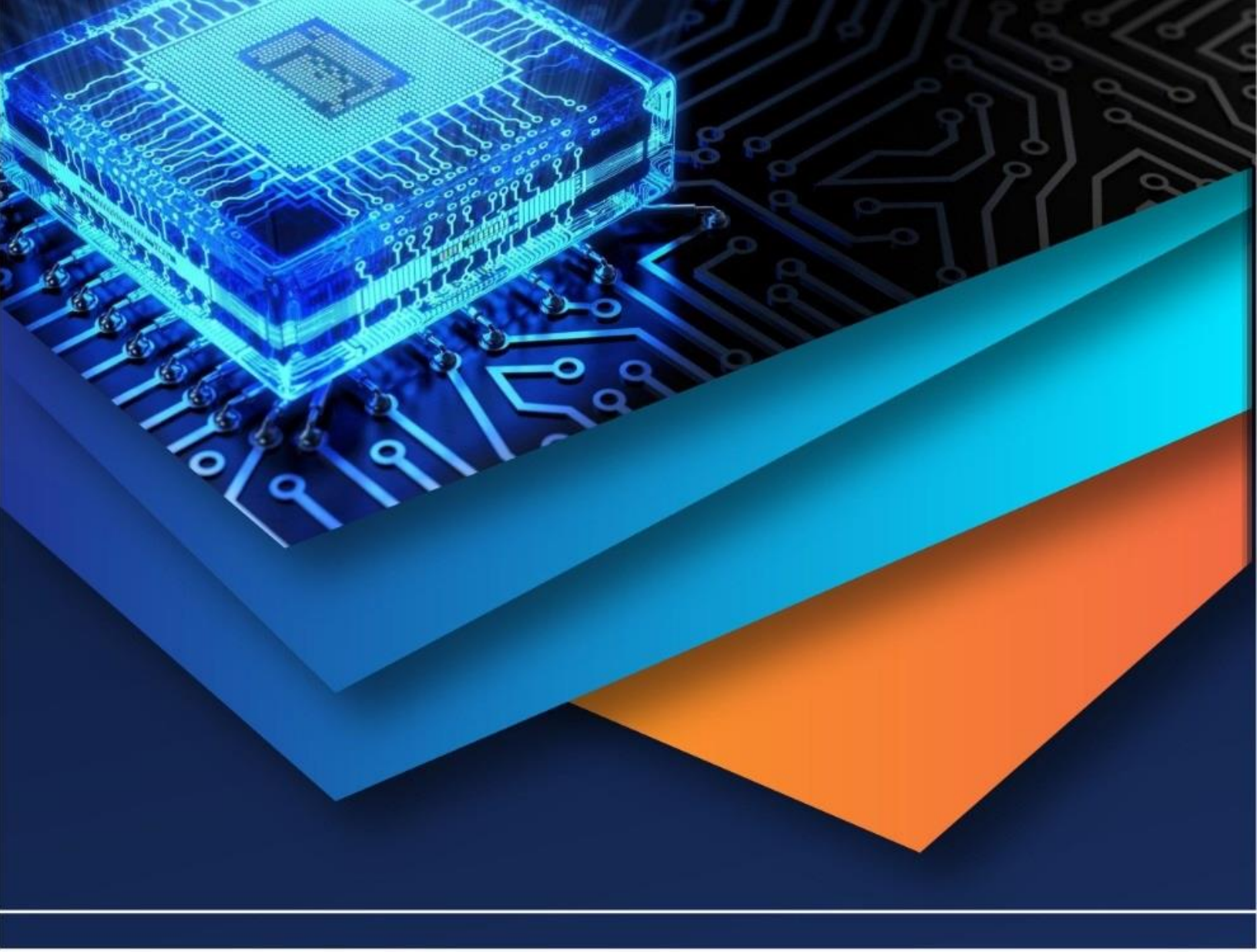
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