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Hardware Based Braille Pad on Mobile Phone

Prof. Amar Banmare[1], Ashika S. Chawhan[2], Aditi R. Lanjewar[3] Karishma R. Nikhade[4], Meghna P. Siriya[5]
[1, 2, 3, 4, 5,] *Electronics and Telecommunication Engineering, GNIET, R.T.M. Nagpur University*

Abstract: ***This paper proposes an aim to provide Microcontroller (PIC16F877A) based Braille Pad system which provide information to blind people by using Global System for Mobile Communications(GSM), helping the visually disabled to communicate. Braille is a system of six raised dots that can be read with the fingers by people who are blind. To print dots we have used six solenoids valve controlled by microcontroller using relay. The details of simulation in Proteus 8 professional software, and embedded module have been furnished in this paper.***
Keywords: Microcontroller, GSM module, embedded module, Braille, UART

I. INTRODUCTION

Present days, blindness is one of the major diseases. 37 million people across the globe are blind and over 15 million are from India. So there is high demand in developing an assisting device for them to provide education through the low cost Braille pad.
Braille is a system of raised dots that can be read with the fingers by people who are blind or who have low vision. Braille is not a language. Rather, it is a code by which many languages. Braille is used by thousands of people all over the world in their native languages, and provides a means of literacy for all. Braille symbols are formed within units of space known as Braille cells. A full Braille cell consists of six raised dots arranged in two parallel rows each having three dots. The dot positions are identified by numbers from one through six. Sixty-four combinations are possible using one or more of these six dots.

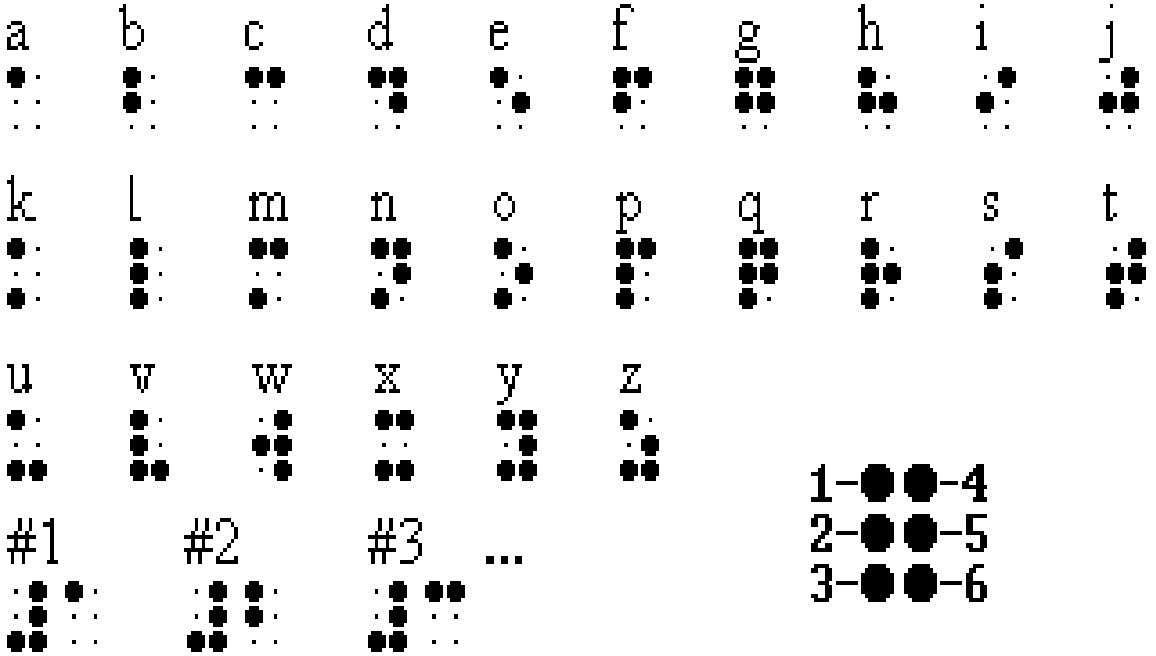

Fig. 1 Braille Alphabet

II. PROPOSED SYSTEM

The proposed system design implements microcontroller (PIC16F877A) based braille pad using GSM Module and Solenoid switch. Fig. 2 shows block diagram of proposed system in which power supply is connected to give 5V supply to microcontroller and 12V supply to operate relay. GSM module is connected to receive message. The blind person's mobile number which is connected to the microcontroller which reads the SMS using GSM module through the AT commands and then converts the letters of the SMS into the Braille language using the lookup table in its memory. Relays are energized according to the input from controller. As per the received commands the solenoid valve are toggled up and down and print dots. Thus the blind person will be able to sense the letter. All ongoing process is displayed on LCD (16x2) module.

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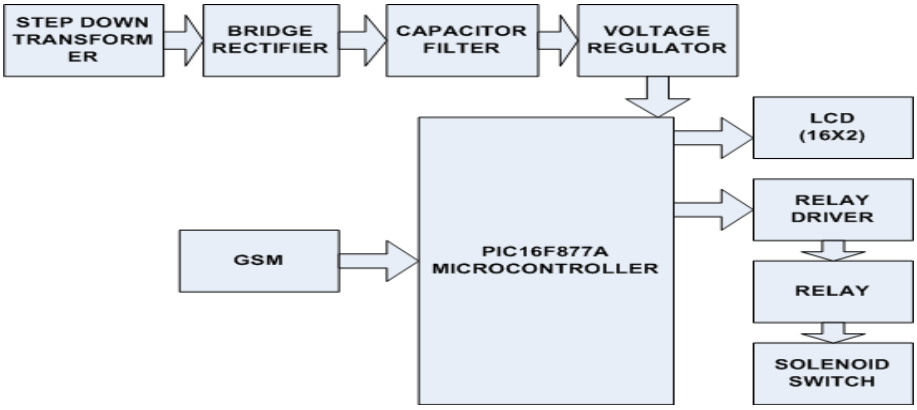

Fig. 2 Block diagram of proposed system

A. Microcontroller (PIC16F877A)

PIC is a family of RISC microcontrollers made by Microchip Technology, 40-Pin 8-Bit CMOS FLASH Microcontrollers. Microcontroller programed in Embedded C language. Having useful Features like,

1) Operating Frequency: DC – 20 MHz
2) EEPROM Data Memory (bytes): 256
3) I/O Ports: Ports A, B, C, D, E
4) Timers: 3
5) Serial Communications: USART
6) Instruction Set: 35 Instructions
7) Programmable code protection

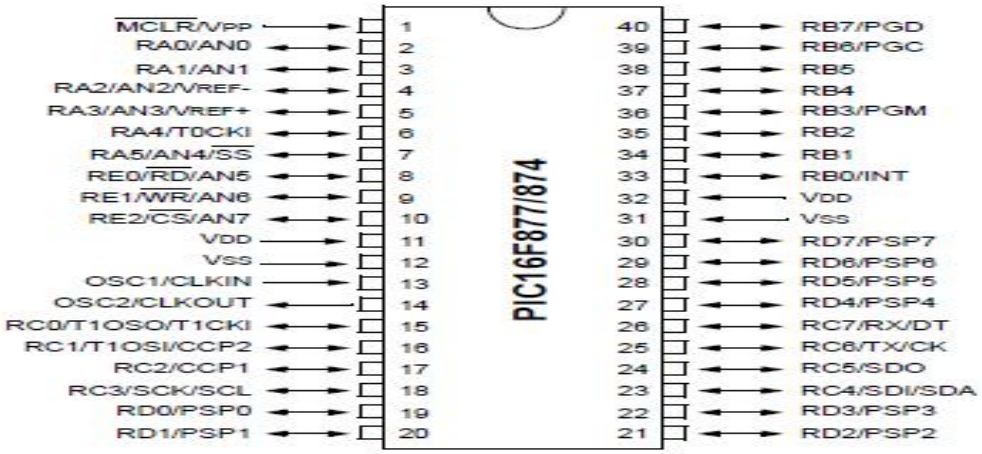

Fig. 3 Pin Diagrams of PIC Microcontroller

B. Power Supply

To operate Microcontroller and Relay 5V DC and 12V DC power supply is needed respectively. The AC voltage is connected to Step down Transformer, which steps down AC voltage amplitude. To rectify signal a full wave bridge rectifier this gives pulsating DC. Capacitor filter connected in parallel with the load gives DC voltage which contains ripple in it. To get pure DC regulator IC (7805 for +5V, 7812 for +12V) is used.

C. GSM Module

The on-board GSM module is responsible for receiving the SMS containing the information which other people want to communicate with visually disabled person who is carrying the device. GSM Modem-RS232 is built with Dual Band GSM engine-SIM900A, works on frequencies 900MHz. The baud rate is configurable as 9600. The GSM module is controlled by AT commands which are sending through USART using microcontroller. Table1. Shows AT commands used to control the operations of GSM modem.

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TABLE I
AT Command of GSM Modem

Command	Operation
AT	Initialize GSM
AT+CSMS	Select message service
AT+CMGF	Message format
AT+CMGR	Read message

D. Solenoid Valve

To control the flow of liquids i.e. ink solenoid valve is used. Solenoid valve is an electromechanical controlled valve. Valve is an electric coil with a movable ferromagnetic core in its centre. Electric current creates a magnetic field which exerts a force on the core. As a result core pulled toward the centre of the coil so that orifice opens and it prints dots. The controlling of solenoid valve is done by microcontroller (PIC16F877A) using relay and relay driver circuit.

E. Relay and Relay Driver Circuit

Relay is Electro mechanical switch which provide simulation between low level circuits and high level circuits. Relay consist of coil when electric supply is given then it will get magnetize and attract metal plate which will switch on relay and connected solenoid valve get start working. To control relay through microcontroller we have used Two NPN Transistor (BC547). Whenever logic 0 is applied from microcontroller, relay get magnetize and switch on solenoid valve and whenever logic 1 is applied relay will is in off state. Two Resistors (10Kohm) were used to make voltage division. To protect transistor circuit from back EMF we have given freewheeling diode (1N4007) connected between two input terminal of relay. The combination of transistor and resistor circuit's forms relay driver circuit.

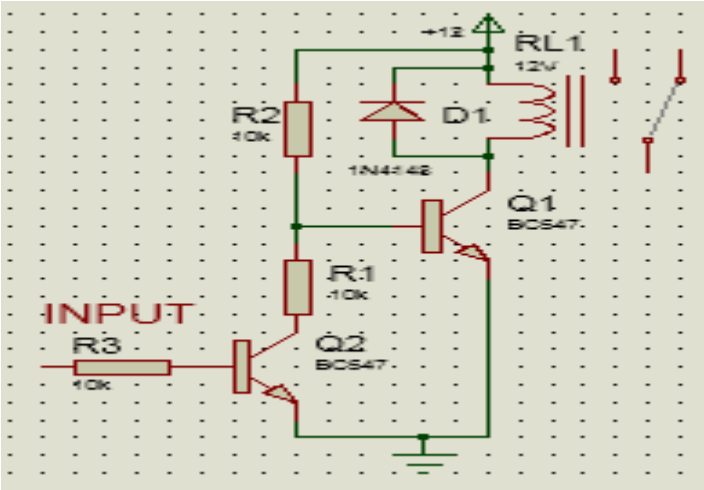

Fig. 4 Relay with Relay Driver Circuit

III. SIMULATION AND IMPLEMENTATION RESULT

In order to implement the proposed model a PIC16F877A- Micro controller and Sim 900 module as the GSM module are used. Circuit simulated on Proteus 8 professional software and hardware implemented. The PIC 16F877A is an 8-bit controller with inbuilt ADC (Analog Digital Converter), USART (Universal Synchronous Asynchronous Receiver and Transmitter), Timers, Comparators, SPI (Serial Port Interface) and I2C (Inter-Integrated Circuits). Embedded C is used to program it. The Sim900 module is connected to the USART of the PIC 16F877A through the pins RC6 (Transmission) and RC7 (Reception). To turn on microcontroller 5V supply and for Relay 12V supply needed. Figure V shows circuit simulation of power supply circuit. Arrangement of relay circuit, LCD and GSM shown, Also simulation of arrangement is shown in fig. 6. To communicate with GSM module we required UART (Universal Asynchronous Receiver Transmitter) which is inbuilt in PIC microcontroller. AT commands are needed to activate GSM module which we are given through programming using UART. Fig. 7 shows simulation of GSM modem in which command are shown in virtual terminal. Complete circuit and Embedded C program are simulated and hardware are implemented as shown in fig. 8.

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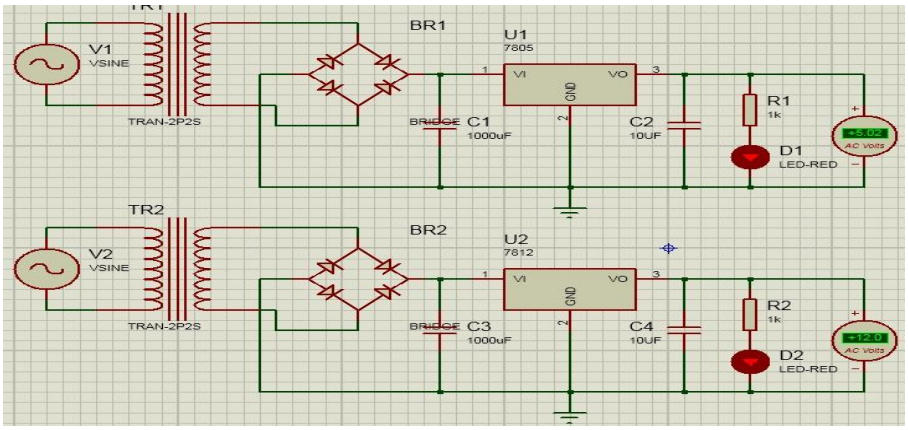

Fig. 5 AC to DC Power Supply Circuit

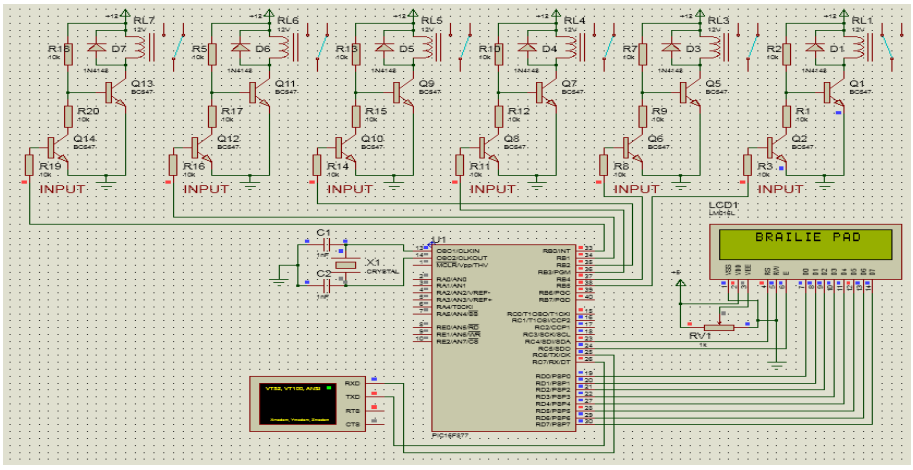

Fig. 6 Circuit Arrangement of Proposed System

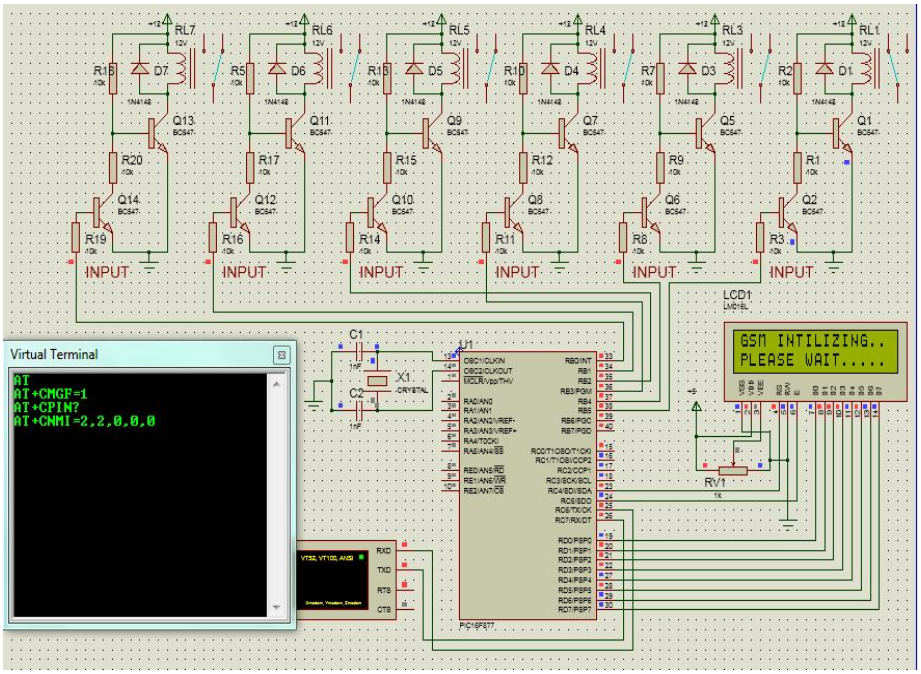

Fig. 7 GSM module simulation

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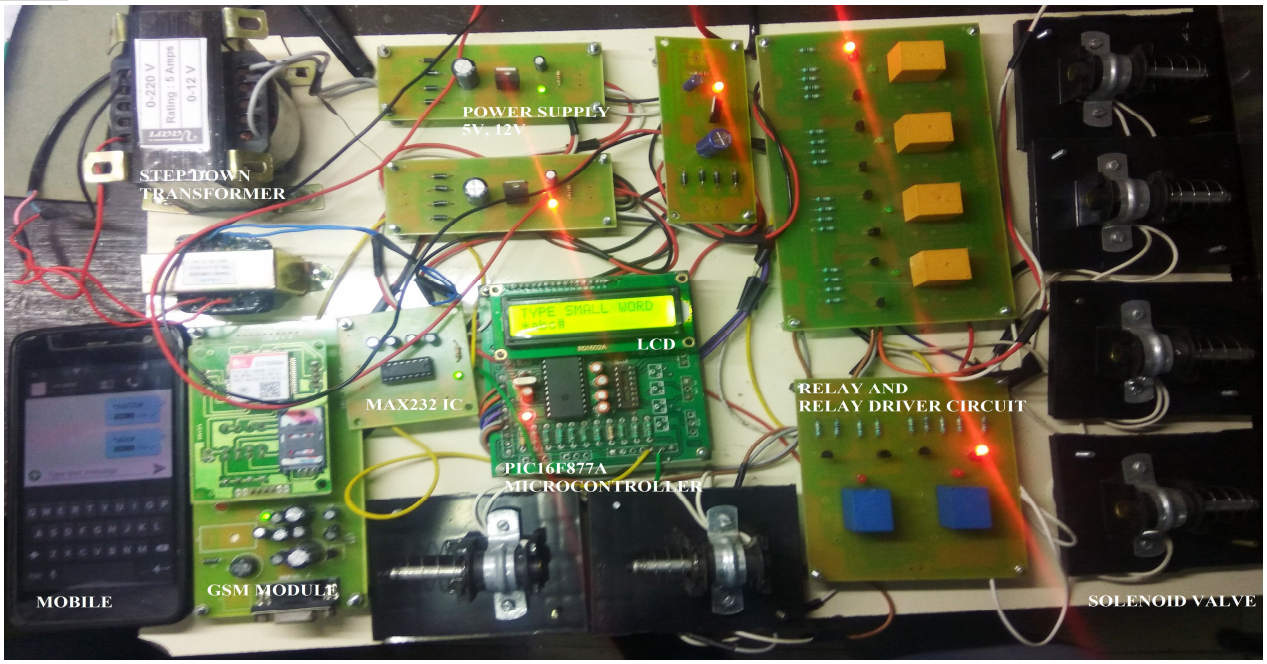

Fig. 8 Hardware Circuit of proposed system

IV. CONCLUSIONS

In this paper, embedded based user friendly and cost effective Braille pad system using GSM and Solenoid Valve has been develop. Due to PIC16F877A microcontroller features hardware requirement is reduce also cost get reduced. Our system capable to print alphabetical characters in Braille code which is helpful for visually challenged person. Circuit simulated by using Proteus 8 software which is also use for PCB design. Efforts are still made to incorporate more features in the proposed Braille pad system.

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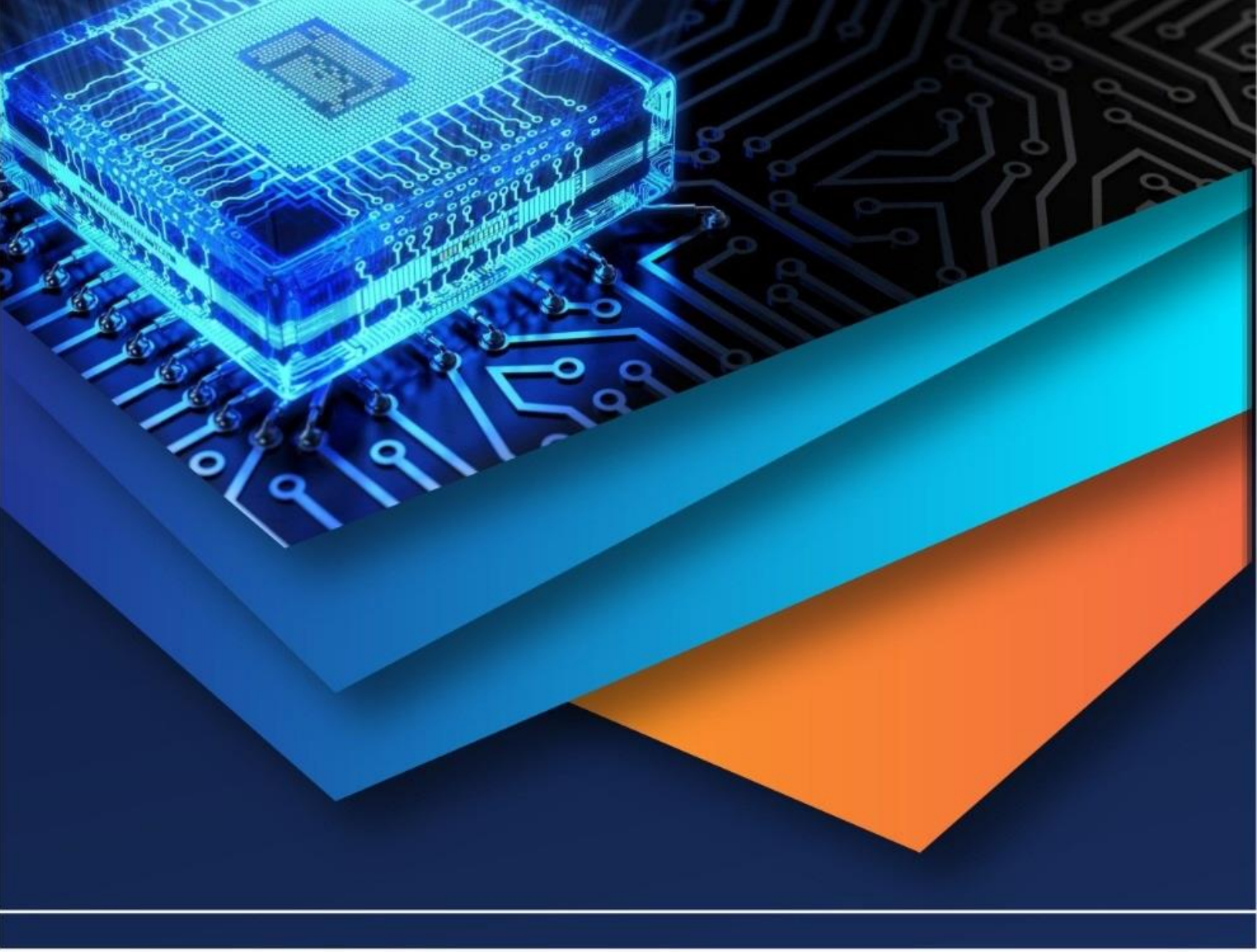

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