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Design and Implementation of Effective Digital Photo Frame

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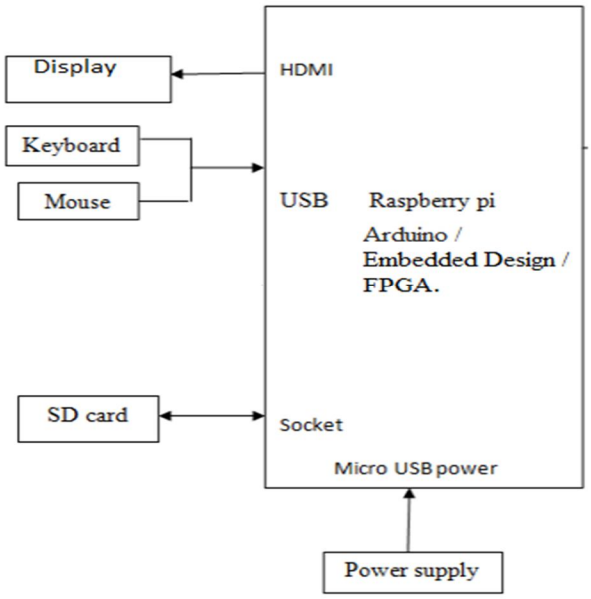
Abstract: ***Digital picture frames are nice because they let us enjoy our photos without having to print them out. Plus, adding and removing digital files is a lot easier than opening a traditional frame and swapping the picture inside when you want to display a new photo. In this paper, we are going to implement Digital Photo Frame using Raspberry Pi,***
Keywords: Digital Photo Frame, Raspberry pi Arduino, Embedded Design, and FPGA.

I. INTRODUCTION

The majority of tabletop photo frames are designed to be used with printed photographs and if one wants to change them, he/she will have to do it manually because photos will not be updating automatically. Directly speaking, the digital photo frame takes the place of paper photographs, which display the
photos through a screen of LCD, it can read photos from the SD card, and display strips. Reasons to implement this project as follows-

1) To display as many as pictures we want in Digital Photo Frame.
2) All the processes will be paperless.
3) On one press we can play slid show.
4) Most important it will be very cost-effective.

Block Diagram



1) Here we are going to provide images from the SD card and it will have different types and different sizes of pictures.
2) Raspberry Pi, Arduino, embedded Design, FPGA will be used to find out which one is more efficient and resilient based on their outputs.

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II. HARDWARE IMPLEMENTATION

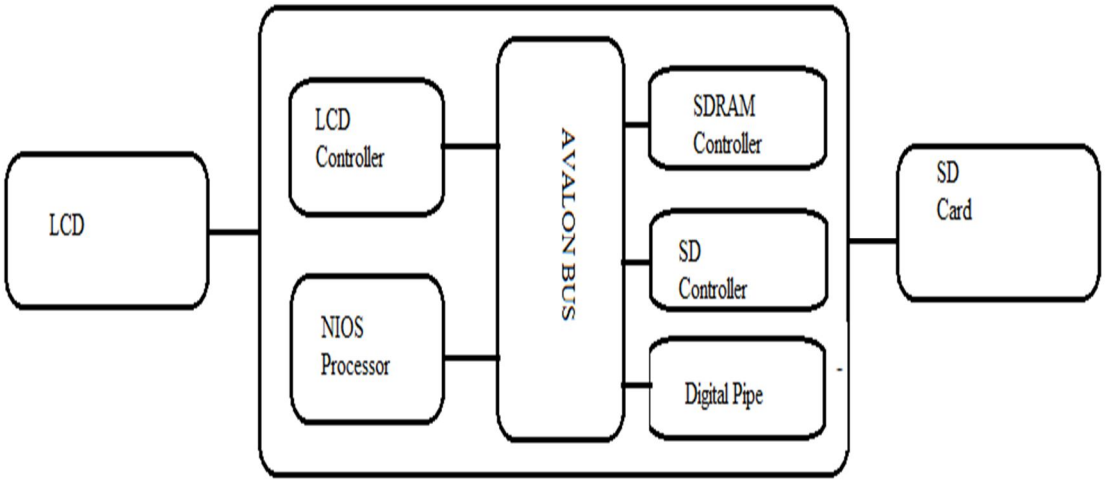
We are going to design and implement of Digital Photo Frame using the following methods.

A. Digital Photo Frame Based on FPGA

1) Von Neumann architecture is adopted to build hardware systems and Altera's Avalon bus mode is used in this paper.

2) Nios II completed data exchange with the outside world by Avalon bus. Avalon bus characteristic is all the peripherals interface with the Avalon bus clock synchronization.

3) So that simplifies the Avalon bus timing behaviour, to facilitate the integration of high-speed peripherals.



4) The SD card has the advantage of small size, large capacity, cheap, it easy to upgrade, so the system has a wide range of applications.

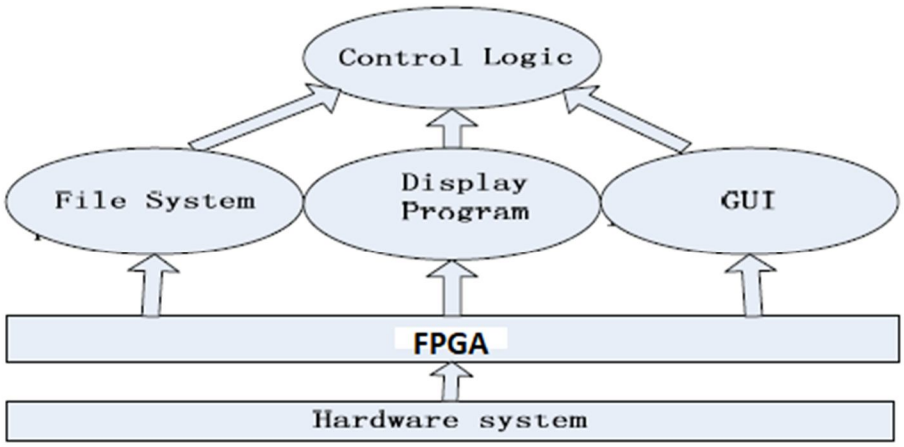


Fig. The block diagram of the software system

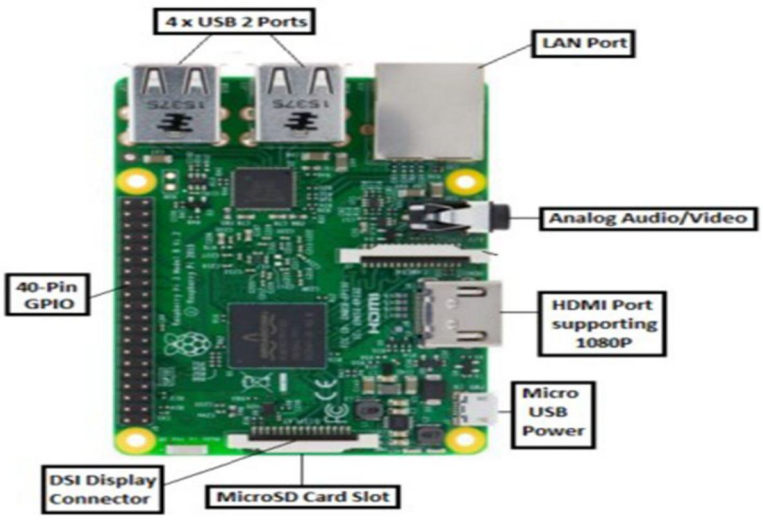
5) The software uses a hierarchical design methodology, First of all, according to the hardware system design driver, and then the advanced features of the software program are implemented by calling the driver, software system block diagram shown in Fig.
6) The driver is a snippet of code that is added to the operating system.
7) It contains information relating to hardware, to provide top software operating interface. The information of these interfaces can ensure that the computer communicates with the device. To achieve greater versatility and portability, this design uses a hierarchical structure.
8) To achieve a richer effect, a software program used to process pictures. The software program includes the file system, programs and user graphical interface program.
9) In the process of user operation of the keys on the screen, the mechanical jitter occurs within a certain period, when voltage the signal generated by this jitter exceeds the threshold of digital logic, logic error is generated, making the system-generated error response.
10) So need to write the screen key anti-shake image stabilization program, therefore need to write the screen button Shake Reduction program.

B. Digital Photo Frame Using Raspberry Pi

1) This project is using Raspberry Pi model B as the core processor where several input slots are available to display images like USB, SD card socket.
2) It has an output slot also which is connected to the display screen to showcase the images from the input. In Raspberry Pi 3, the user can connect to the full HD display.
3) Audio-out jack is also available to connect it to the speakers.
4) A power socket is also provided in the micro USB port to provide the power of 5V to operate this processor.
5) It has a 64-bit Quad-core processor which makes it almost 10 times faster than the previous versions of Raspberry Pi.
6) Users can also run the official Raspbian operating system.
7) Apart from Raspberry Pi 1 & 2, Raspberry pi 3 supports a RAM of up to 1 GB.
8) Features like WiFi and Bluetooth are also been introduced in this version of the Raspberry Pi series making it more comfortable for the user to connect it to the destination folder containing all the pictures.

Image resolution - 1024X600
Pixels – 720p
Raspberry Pi 3

PCB Design



Raspberry Pi 3B

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III. SOFTWARE CODING

Download the Raspberry Pi Imager as per our operating system and install it. After installing follow the below-mentioned steps to extract the features.

1) Connect the screen and keyboard to your Raspberry Pi.
2) Boot and update Raspberry Pi OS.
3) Load to install SAMBA libraries, create directories and slide show,
4) Changes in SAMBA configuration file.
5) Add user to access Raspberry Pi through SAMBA.
6) Connect the input source of the image.

```
[global]
client min protocol = SMB2
client max protocol = SMB3
vfs objects = catia fruit streams_xattr
fruit:metadata = stream
fruit:model = RackMac
fruit:posix_rename = yes
fruit:veto_appledouble = no
fruit:wipe_intentionally_left_blank_rfork = yes
fruit:delete_empty_adfiles = yes
security = user
encrypt passwords = yes
workgroup = WORKGROUP
server role = standalone server
obey pam restrictions = no
map to guest = never
[pi]
comment = Pi Directories
browseable = yes
path = /home/pi
read only = no
create mask = 0775
directory mask = 0775
```

A. *A Design of Embedded Digital Photo Frame*

1) This method introduces the Digital Photo Frame based on Samsung S3C2440 chip, Linux operating system and Qt / Embedded, which realizes playing a variety of formats of photos like a magic lantern.
2) The hardware circuits of the design include the CPU of Samsung S3C2440A with frequency up to 533MHz, which can continuously playback the popular MP3 format audio files for 44.1KHZ.
3) NOR FLASH Am29LV800DB which is introduced by the SST's capacity to 8M bits,
4) 1M bytes of CMOS multi-purpose flash, 64M bytes of SDRAM, which is composed of two K4S561632 working in 32-bit mode, 64 Mbytes of NAND Flash K9F1208.
5) 10M Ethernet interface CS8900Q3 with transmission and connection indicator, LCD and touch screen interface.

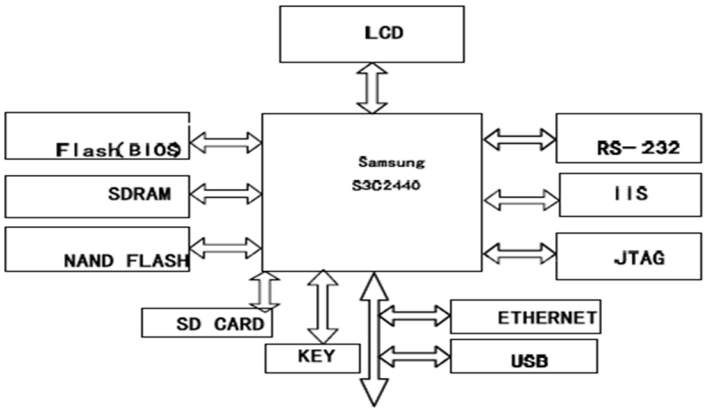

Fig. hardware architecture of S3C2440

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B. The Analysis of IIS (internal IC sound)

IS bus interface of 3C2440A can be used to achieve functions of data transfer for external 8/16 stereo audio, and meet bit wide for the popular 16Bit MP3, WAV file.

C. The LCD Module

1) The LCD module is the main module of the digital photo frame, which display the images.

2) Zooming effects and moving effects of these images. The system of this design includes: the choice of 3.5-inch LTV350QV LCD (TFT type), whose maximum refresh rate is 90Hz, resolution 320 x 240, using 16-bit true colour.

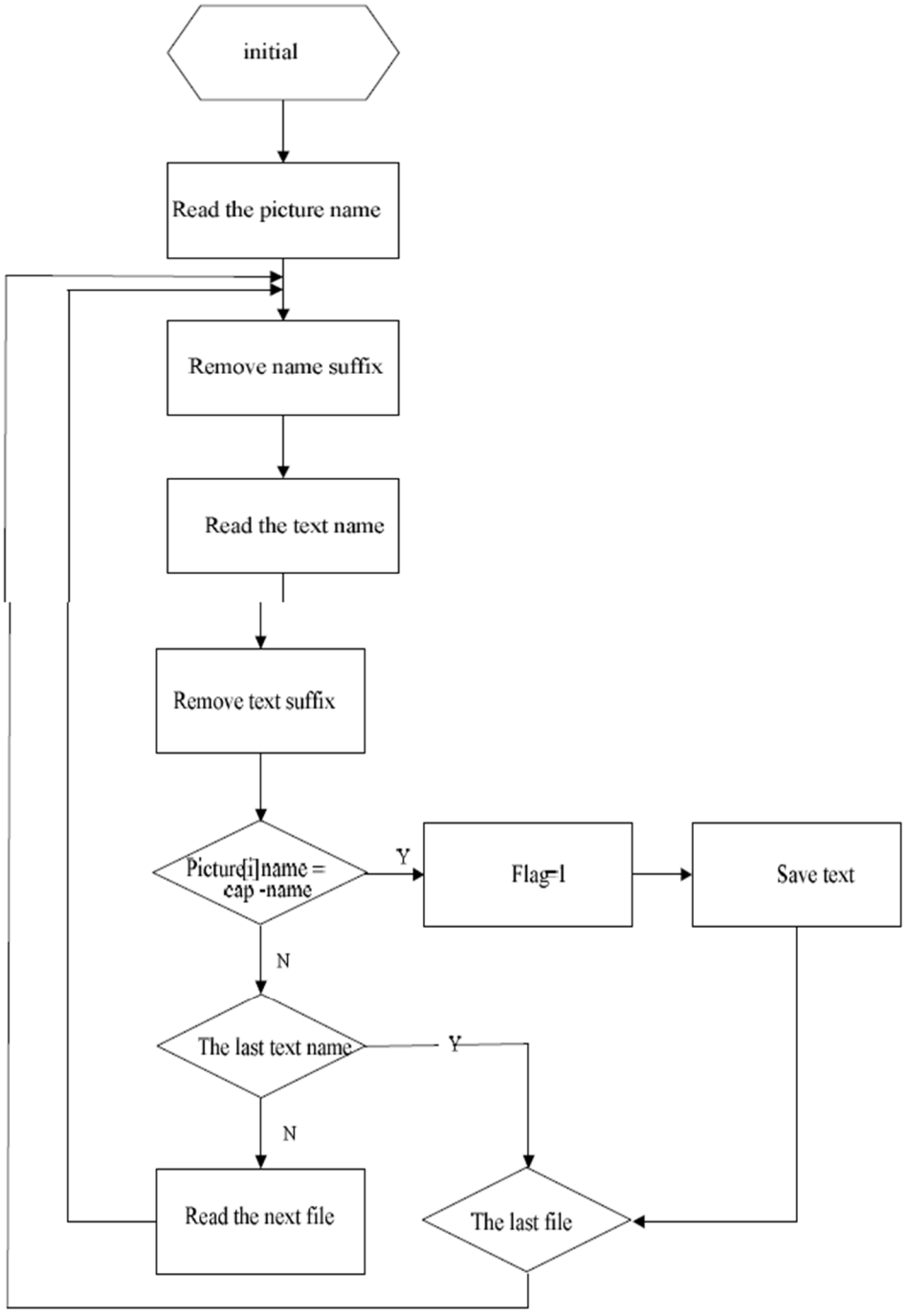

Fig. the flow chart of reading picture

D. Building Digital Photo Frame Using Arduino

- Here in this project, we are going to implement a simple photo frame that loads images from the SD card.
- I have placed some .bmp images on the SD card and the project loads them and displays them at the display in full colour!
- The speed of the project is very high if we take into consideration that the brains of this project are the Arduino Nano. In my opinion, this is impressive.

1) Zhe Parts Needed To Build This Project Are These

a. An Arduino Nano
b. A 1.8" ST7735 Display
c. A small breadboard
d. Some wires
e. An SD card

2) Display

a. First of all the ST7735 Color TFT display is a very inexpensive display. It has great library support.
b. Furthermore, the display offers a resolution of 160×128 pixels, and it can display 65.000 colours. It uses the SPI interface to communicate with the Arduino boards.
c. In addition to that, it works well with all the available Arduino boards, like the Arduino Uno, the Arduino Mega, and the Arduino Due. It also works fine with ESP8266 based boards, like the Wemos D1 and the Wemos D1 mini-board.

```
void loop() {

 bmpDraw("logo.bmp", 0, 0);

 delay(3000);

 bmpDraw("mezapos.bmp",0,0);

 delay(3000);

 bmpDraw("sparti.bmp",0,0);

 delay(3000);

 bmpDraw("mani.bmp",0,0);

 delay(3000);

 bmpDraw("lisbon.bmp",0,0);
 delay(3000);
}
```

d. In the above code With the bmpDraw function offers easily load and display bitmap graphics in our projects.
e. To convert the images to the correct format for this project, use the Paint.net free software for windows.
f. Load images and then I resized in the correct resolution for the display which is 160x128 pixels.
g. Then save the images as .bmp files with a bit depth of 24bits.
h. That's it, all we have to do now is to save them to the SD card and call the command bmpDraw with the name of the file.

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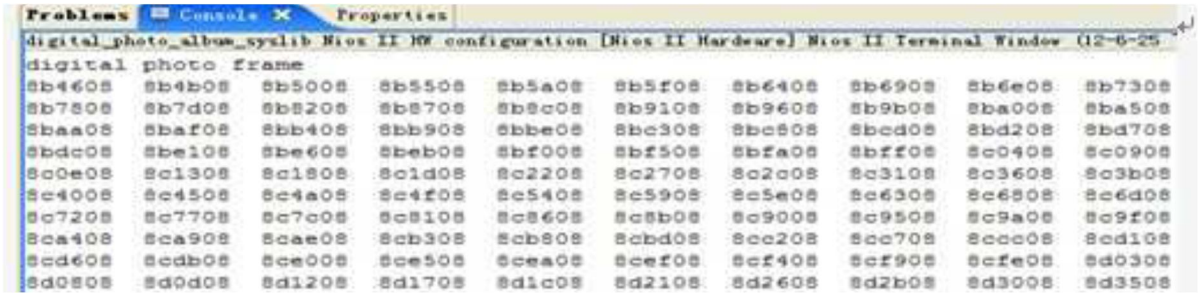
IV. RESULT

A. Result of Digital Photo Frame Based on FPGA

1) The SOPC IP is used to improve design efficiency and accuracy.

2) CPU module uses Overclocking Technology so that the CPU can have better performance, to meet the higher data processing speed, timing-driven of SD card is optimized, SD card reading and writing speed has been improved.

3) Functional correctness is verified by Quartus II, further downloaded to the FPGA for debugging, the observation results showed that digital photo frame has a high degree of freedom in the system optimization.



B. *Digital Photo Frame Using Raspberry Pi*

1) It provides the memories with a professional appearance and is a method that is designed for long-term use and is usually maintenance-free.

2) The Raspberry Pi is probably the best CPU for this device's operation. There are numerous possibilities for displaying a picture as an input source.

3) The major goal is to reduce costs, which may be accomplished by using a perfect and economical CPU and display.

C. *Design of Embedded Digital Photo Frame*

1) The proposed system can display many kinds of format photos such as BMP, GIF, JPG, PNG, etc.

2) .bmp format pictures will be displayed.

3) This design is quite promising in the future. Modules of Ethernet network and WIFI can be added, which can help to realize the function of obtaining files from the internet.

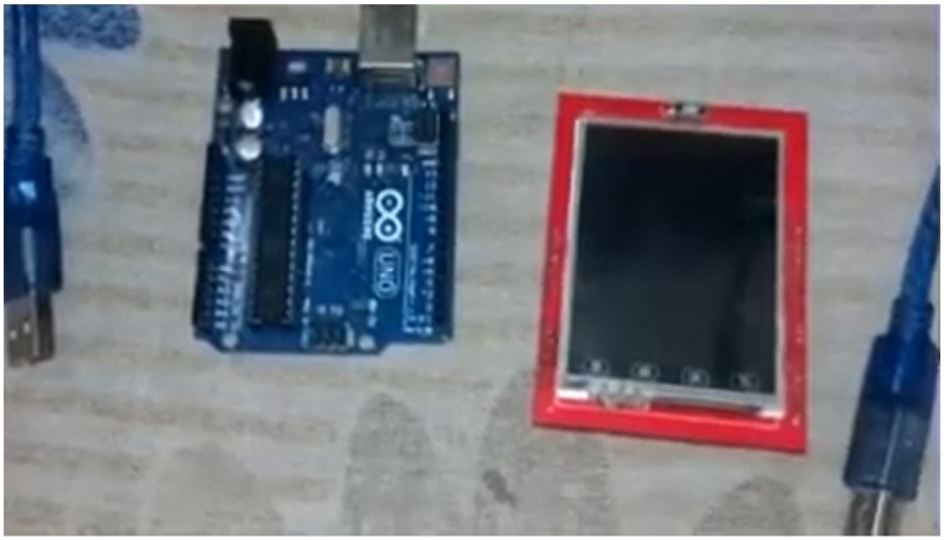
4) It can work with different types of picture formats but comparatively, it works slower than raspberry pi.

D. Digital Photo Frame Using Arduino

1) It provides a professional small appearance and is a method that is designed for long-term use and it will be maintenance-free.

2) The Arduino is probably the best CPU after Raspberry Pi for this device's operation. There are numerous ways for displaying a picture as an input source.

3) The major goal of Arduino is to reduce costs, as well as it will be very compact compare to other frames which may be accomplished by using Arduino.



V. CONCLUSION

Comparing all the factors like different processers and their processing speed, different types of displays, and which one will be compact studying all these different aspects we can say that **Raspberry Pi** will be perfect to build Digital Photo Frame. Raspberry Pi have a different feature also that we can implement in our project. It has a very fast processing unit which will help us to change the number of pictures in a small amount of period.

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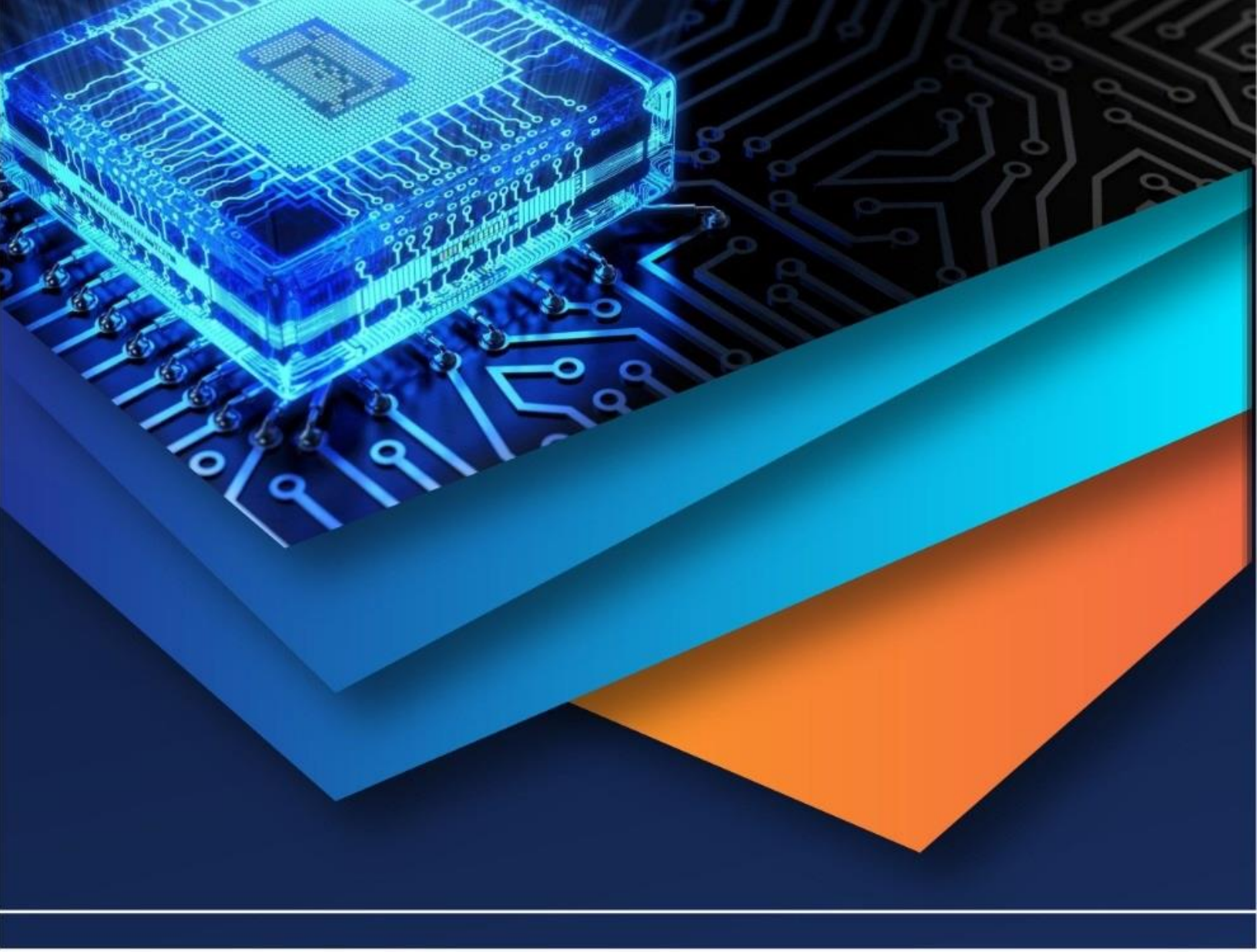

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