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USB to USB Data Transfer without Pc

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Abstract: ***The computer has become an important part of life for many people in the world. Its innumerable uses have changed the life of many, not only in technical field but also in non-technical field. This paper discusses a modern approach towards the way the data is transferred to and fro in the USB mass storage devices without using a computer. Now-a-days with increasing use of computer, most of getting aware of the devices that are associated with it. To operate these devices most of the times an operating system is required which calls for the host which is extremely complicated system. The current scenario is that you need to have a USB enabled computer to do the task of data transfer. It is difficult to take the computer always with you wherever you go for the sole purpose of data transfer. The main concept of this project to avoid the use of these complicated hardware for data transfer which is the need of life for many people in this world. The aim of this project is to transfer data without using a computer, from one USB to another. To do so, the system uses an independent solution for the problem – USB to USB Bridge. This bridge will help the user to select a particular data file from the mass storage device connected to one of the ports and transfers it to the other mass storage device using some controls like explore, list, copy provided on the front panel. The data into the USB mass storage device will be explored using the USB host. The touch screen displays the list of explored files from the mass storage device. The D+ and D- are bidirectional lines, both carrying data in a single direction in TDM manner. The portability and battery operated are the major advantages of this system. It is an embedded solution to a practical problem.***

Keywords: USB, FAT, Flash Disk, ARM7

I. INTRODUCTION

The need of transferring data, in minimum possible time, from one USB Flash Drive to another has become essential after the success of USB Flash Drives or as we say 'pen drives'. It involves a series of processes to achieve a successful transfer when being done with the use of a computer. Starting with locating a working computer system, connecting the Flash Drive to the USB port, and waiting for the computer system to recognize the device after the driver has been installed, to finally selecting the data to be transferred, and ensuring that the transfer did occur. All of this consumes a lot of time and power too, as the computer is required to be totally functional before transferring the data. It is also not feasible to carry around the laptop everywhere with you when there is a much more viable and convenient alternative.[4] This project aims at making the use of a computer for USB to USB data transfers antediluvian with our model which will perform the task of transferring the data from one USB to another without making the use of a computer system.

II. REQUIREMENTS OF SYSTEM

To represent this innovative idea into a real time model we have set up a few requirements that will make the design and composition of the system clear and also ensure that the outcome is as desired.

A. Requirement 1

The first and foremost need was to consider the USB protocol. This is to provide a background of the project and also to get to know the ease of operation of the different speed modes of the USB.

B. Requirement

The data transfer speeds should be commercially competitive.

C. Requirement 3

Knowing that the present technology is not economical, we require to focus on commercially versatile technologies and cheaper alternatives to the existing ones which are not budget friendly.

D. Requirement 4

Our design should cater to the market's need especially in being of cost effective and reduced power consumption

III. SYSTEM ARCHITECTURE

The USB to USB data transfer device consists of the following main parts:

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A. USB2.0

USB is a master-slave bus with one master and multiple slaves. The master is called a host and the slaves are the peripherals. Only the host such as a computer system has the ability to initiate the data transfers; the slaves only respond to the host's instructions-they never initiate transfers.[2][3]

The communication made by USB is based on logical channels - known as 'pipes'. It connects the host controller to the device endpoint. The endpoint is a logical entity which resides onto the device. The connections established are 1 to 1 for the endpoints in pipes. A USB device can have 32 endpoints- two of which are reserved. So a total of 30 are present for normal use.

The data transfer is having four types:

1) *Interrupt transfers:* for the devices needing quick but guaranteed response (e.g. pointing device)
2) *Isochronous transfers*: For some fixed data rate but data loss may take place (e.g. audio, video)
3) *Control transfers*: used for simple status check.
4) *Bulk transfers*: uses available bandwidth with no fixed data rate (e.g. file transfer).
5) The speeds offered by the USB are defined in the USB2.0 specification
6) Low speed: 1.5 Mbps
7) Full speed: 12 Mbps
8) High speed: 480 Mbps

B. ARM7

The main task of the system is high speed data transfer, which depends on the architecture and speed of the processor. The processor should have a USB host with USB device drivers installed in it for plugging in a mass storage device which will be used to transfer data from one device to other. ARM7 is most suited for portable devices due to low power consumption and reasonable performance (MIPS/watts).ARM7 processor architecture is capable of up to 130 MIPS on a typical 0.13 µm process. Theflexibilityandchoicesininterfaces aswellas robustnessprovidedby theARMisveryhighascomparedto others.Thismakesitanappropriateselectionforthedesign andbuildingoftheproduct[10].

C. User Interface Controller Module

This module obtains the user input and displays the user requested information through a touch screen. It consists of three sub modules namely the touch screenController, Navigation and Screen Display Formatter.

The touch screen is used to select the file and displays the path or Long File Name (LFN) format of a file or directory.Theinputsfromthe touch screen areconvertedtotheircorrespondingcommandcodesandareforwardedtothe FileSystemControllermoduleforexecution.Allinformationtobedisplayedis receivedfromtheFileSystemController module.

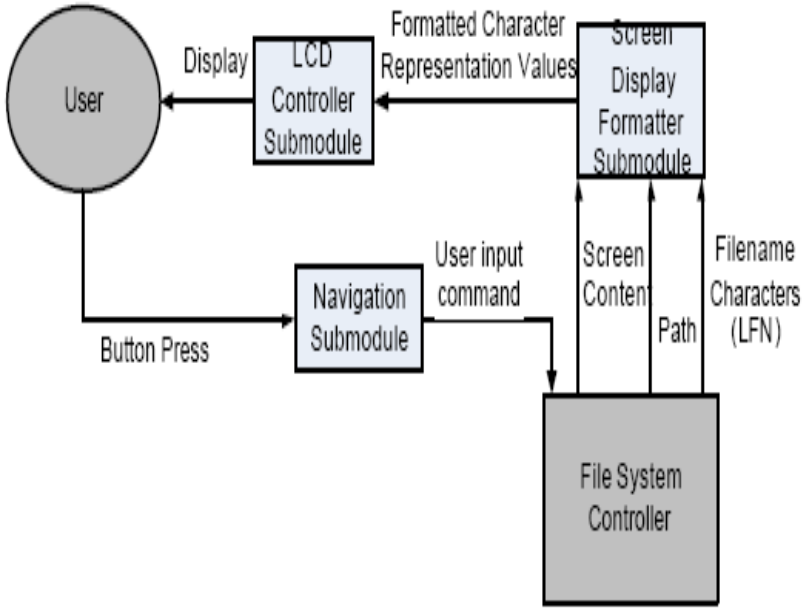


Figure 1. User Interface Controller Block Diagram

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D. Touch screen Controller



Figure 2. Touch Screen For Interface

The touch screen controller is used to interface the touch screen to the main hardware system.It has two USB ports and ARM7 controller which consists of driver files for the touch screen.

E. Navigation

TheNavigationsub moduleistheinputhandlinghardwareof the system. Itsends a corresponding signal for each touch pressed to the microcontroller that controls the touch screenso that it could update the screenand/orsendcommandstotheFileSystem Controller module for processing.

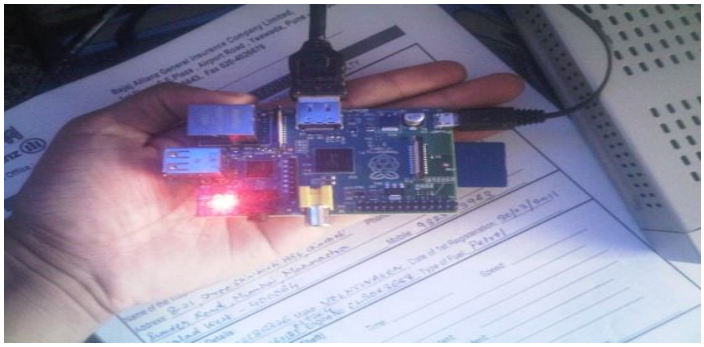


Figure 3. Interface board for navigation

F. Screen Display formatter

The Screen Display formatter is the software part of the User Interface module. It arranges and orders the contents of the touch screen. . It formats the screen to display the appropriate option menus, folder contents, path names, content type (folder or file).It receives the names of the files and folders to be displayed from the File System.

G. USB Host Controller

TheUSB Host Controllersub module is the main hardware used byboththeUSB ControllerModule and theFile System ControllerModule. It interfaces the USB flash drives and converts raw data and information to their proper NRZI encoding as specified by the USB technical specifications. Furthermore, the sub module is capable of encoding or decoding the incoming NRZI data from the USB flash drives and forwards it to their respective sub modules for further processing. Thesystemusesthe Raspberry pi, a programmable microcontroller and USBmulti-role embeddedhost/peripheral controller, which has its own Basic Input/outputsystem and frameworkprogram.Mostofthesoftwaresub modulesmakeuse of the available framework where the functions are already abstracted and simply need to be enabled and customized depending on the application.[6]

IV. FILESYSTEM CONTROL MODULE

The File System Controlleris responsible for all file management processes and FAT file system access for the system.Itmediatesbetweenthedisplay/userinterfaceandUSBcommunicationsmodule.Alargepercentageofthe systemssoftwareisfoundinthismodulesinceitcontainsmostofthesystemscorefunctions The major commands handled by the sub module include the navigation touch screen and the different functions like copy, delete, browsing thru files/folders and the back command.

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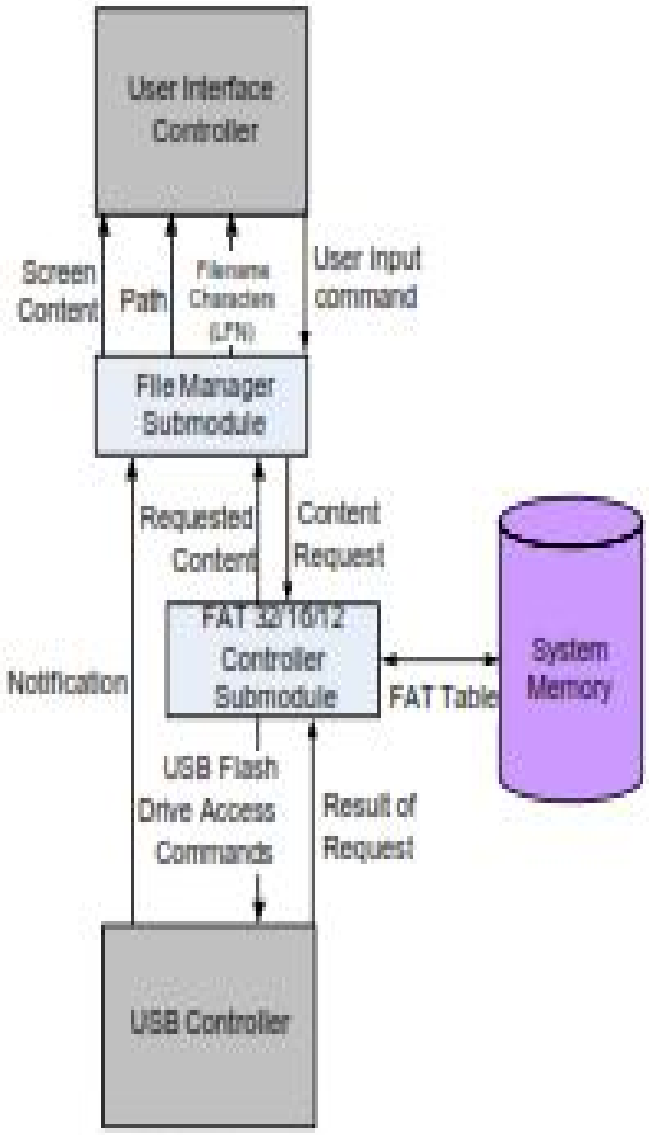


Figure 4. File System Controller Block Diagram

A. FAT32 Controller

The FAT32 Controller acts a mediator between the File Manager sub module and the USB Controller Module. It is responsible for abstracting theFile System so that the File Managersub modulecouldeasilyaccesstheFileSystem. A large portion of this sub module is already implemented by the frameworks included with the Raspberry pi Design kit.

B. Packet Handler

The Packet Handler sub modulehandles all packet generation and interpretation. It generates packets without error checking bits, which will be used as either data, or command packetsdepending on the command sent by the File System Controller Module. It interprets the results and the error free results and status notifications are sent as output.

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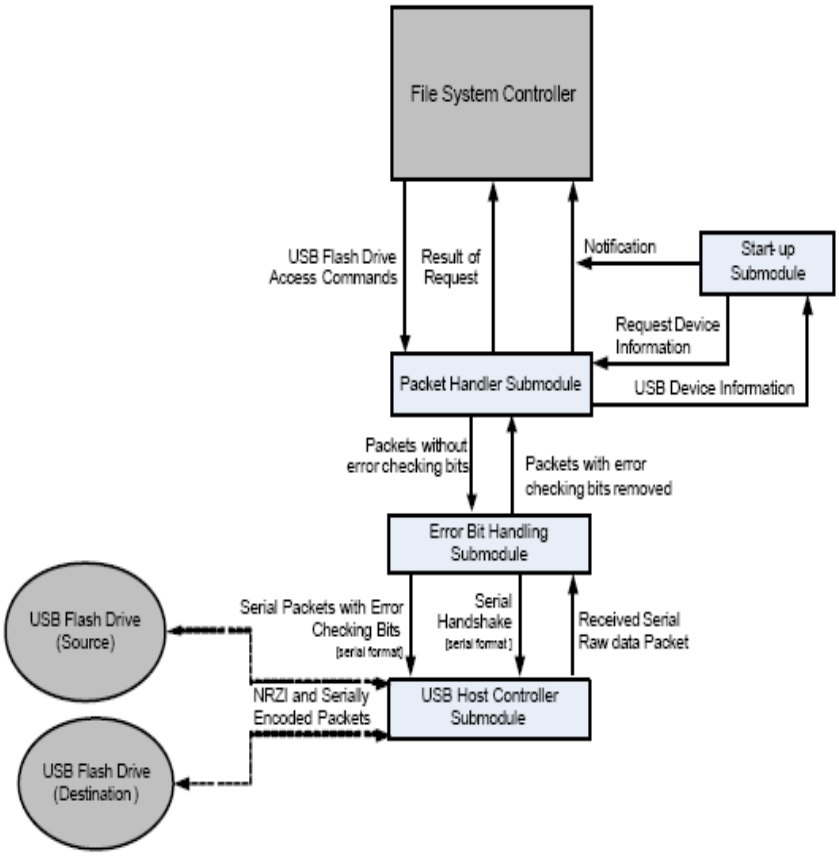


Figure 5. USB Controller Module Flowchart

V. SYSTEM WORKING

A. Hardware Initialization

The USB device shouldbe connected to the hardware after the system boots. When a USB device is connected to the hardware, the initialization starts. Normally it takes1or2 seconds to initialize it. Consider case when we connect the USB device to the hardware in between the boot process, then the error comes into pictures “USB device not recognized”.

B. System Flow

The USB File Transfer Device is a device that facilitates file and folder/directory transfers from one flash drive to another flash drive inter face without the need for a Personal Computer (PC) to act as mediator. The system allows the user to select files or folders/directories for copying from a source flash drive to a user select able directory in the destination lash drive. A touch screen is used to display the contents of the flash drive. The system is also able to check for identical file/folder/directory names and requests for a user confirmation to either proceed and over write a file/folder/directoryornot. The system also checks the availability of sufficient memory space for file/folder/directory to be copied onto the destination flash drive. If not, to free some memory in the destination flash drive the system requests the user to delete some files or folder/directories.

C. Implementation Algorithm

The Implementation Algorithm is as follows

1) Select the suitable development board.
2) Check whether the OS is ported or not
3) Connect the USB device to check functionality
4) Inter face the touch screen and keypad as a User interfaces.
5) Check the communication between the USB device and the board.
6) E x p l o r e the device content son touch screen.
7) Select a particular file, and by using the option COPY, copy that file to destination device Move Button on touch screen.
8) The selected file is then copied into destination USB device that is connected in one of the two USB ports.

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9) If another copy operation is to be performed, then go to step-in.
10) Terminate the process.

D. Termination

One of the features of USB2.0 specification is that when the USB device remain sun-accessed for more than3msec,it (theUSB device)goes into the sleep mode. The USB can now be ejected once the device.

E. System Flow Chart

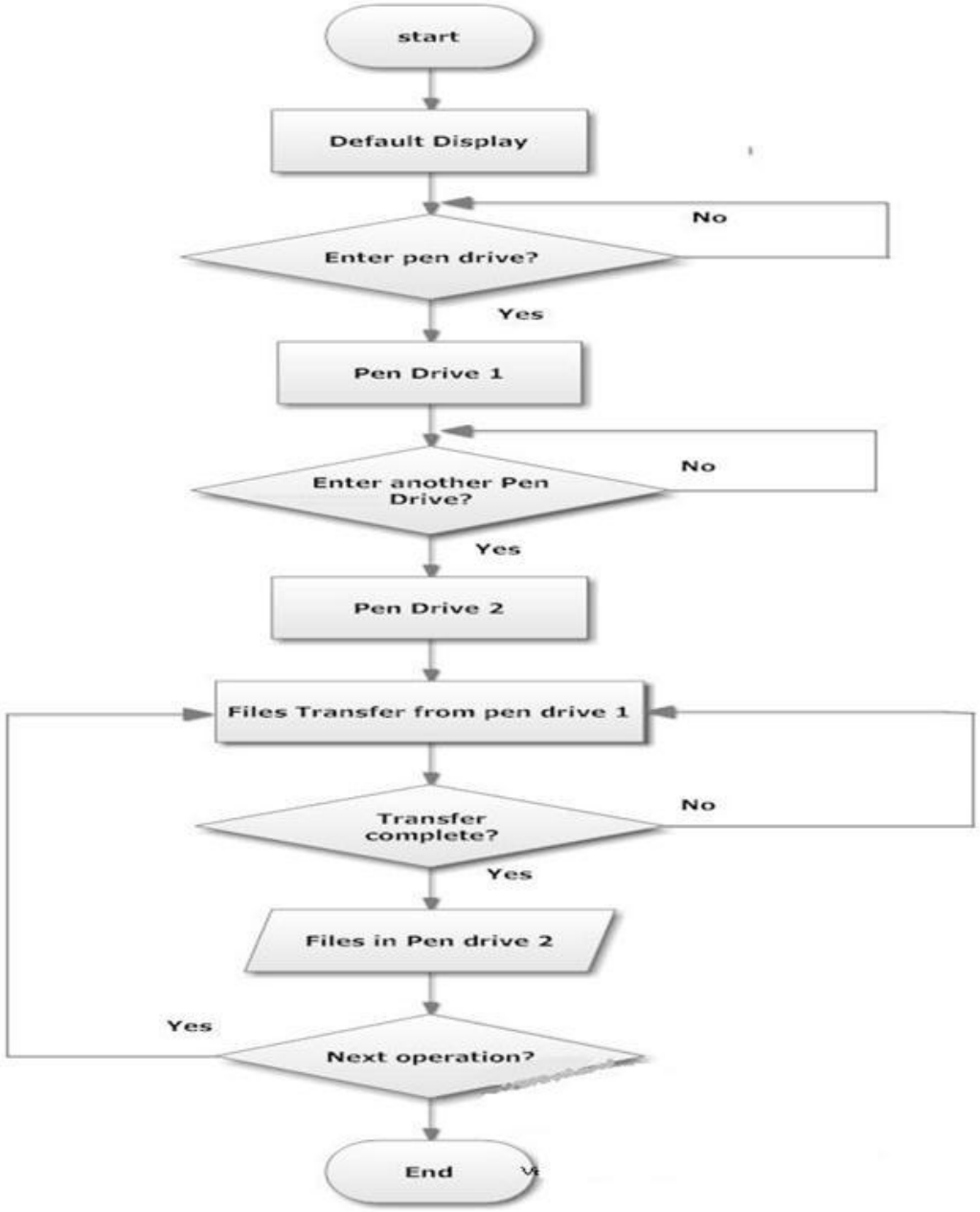


Figure 6. Flowchart of system

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VI. PERFORMANCE TESTS

Three tests are used to assess the performance of the system; speed of the file transfers, accuracy of the copied files, and USB Device recognition

A. Transfer Speed

The results from the transfer speed test show that the speed of the destination devices constant, for all pairs of USB flash disks. Thefiletransferspeedtothegeneric16MBflashdiskaveragesat 199.186Kbps, the 256 MB PQI at 558.191 Kbps, the 512MB PQI at 171.376 Kbps and the 512MB Transcend at 144.548Kbps.[8]

Table 1. USB Flash Drives Used

Capacity	Manufacturer	Model	Year Released
16 MB	Unknown	Unknown	~ 2002
256 MB	PQI	Cool Drive U339S	2006
256 MB	PQI	Cool Drive U339S	2006
512 MB	PQI	Cool Drive U339S	2006
512 MB	Transcend	JetFlash TS512MJF120	2004

B. Single File Copy Test

Single file copy test involves the average speed required to transfer a file, which is calculated by dividing the size of the file to be transferred by the average time Large files are categorized as files over 1024 KB while Medium files are between 20 KB and 1024 KB in size and Small files fall below20KB.

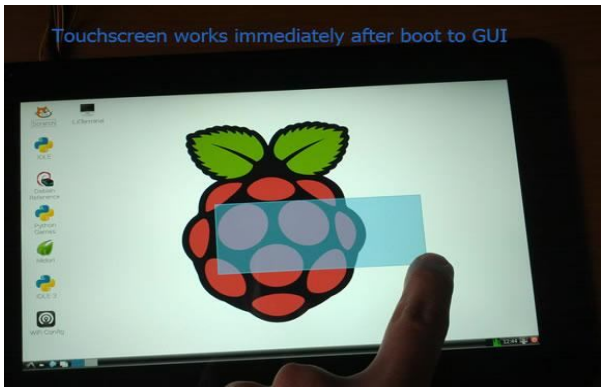


Figure 7. Single file copy diagram

The Folder depths counted starting from the sub directory of the folder/directory concernedThe touch screen will display the folders, sub- folders and the root folders.

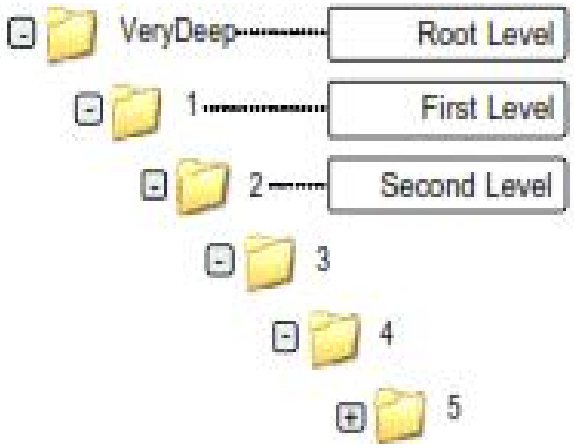


Figure 8. Folder Depth Numbering

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C. File Accuracy

A transfer transaction is considered successful if, for single file copy, the file has been copied completely. For folder copy, all the contents within the folder/directory concerned are copied completely; this includes sub-folders and files within the folders to be copied.

This test utilizes the files obtained from the Transfer Speed test where they are compared to the original files using the Message Digest Algorithm-5(MD5).TheMD5resultsofthe original files are compared to the MD5 of the copied files to verify the integrity of the written data. In total, each test file and folder is transferred 33 times. The accuracy percentage is taken using the ratio of the number of successfully transferred files and the total number of files

VII. ADVANATGES

A. Small, light weight and handy device
B. Poweredby9Vbattery
C. Support for all USB Flash devices formatted with FAT32 file System
D. SupportforUSB2.0
E. Plug and Go function

VIII. CONCLUSION

The USB to USB Bridge concept enables us to study the USB protocol and working of the USB host along with the process oringroup. Aset of basic requirements were defined and used for design work of the USB Bridge. The user interface system is designed to allow the user to browse and choose specific files or folders to transfer between the source and destination devices. The screen consists of only the important data to avoid cluttering the screen.Theadvantageofthisdeviceisthatitisbatteryoperatedsothereisnoneedofpowersupplyconnectionand data transfer can take place at any place. As the system is going to work as an application of the major system ,the number of applications is limitless for the bridge.

IX. FUTURE SCOPE

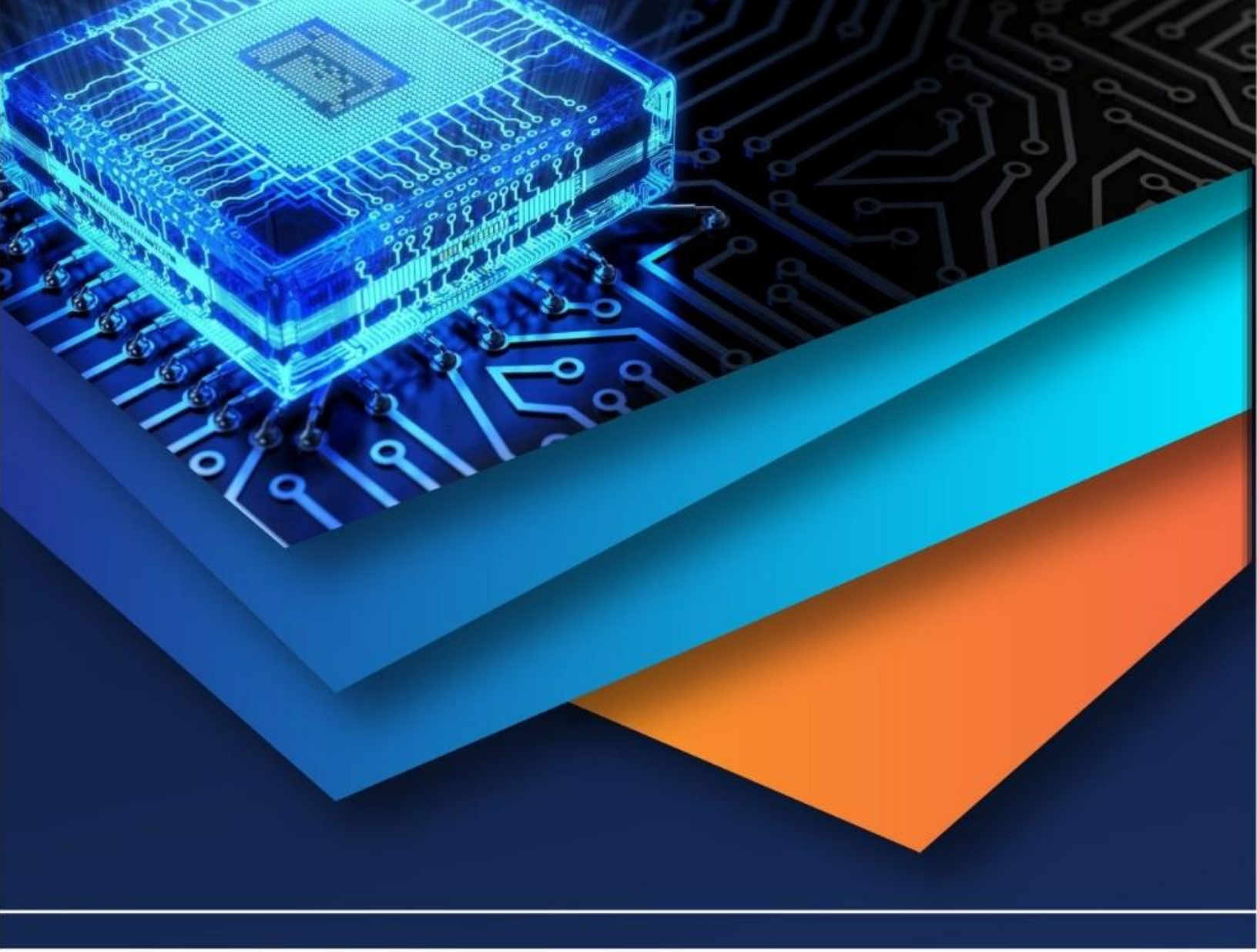
While working on the evolution of the system and exploring the peripherals that could be interfaced with the ARM 7 we got an insight into a plethora of new features that could be added through little alterations. Following are the things that can be done with few modifications.

1) Add USB host capability to embedded products.
2) Update Procedure for USB drive.
3) Wireless data transfer by connection to any Bluetooth enabled devices.

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