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Research on Friendly ARM Board for Data Transfer between Two USB Devices without Computer

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Abstract

The project aims to develop a device that allows file transfers between two USB memory devices without the need for a personal Computer. It is designed as a standalone application which allows for the backup of files from a digital camera or any USB device to another USB Device.This device can eliminate the use of a PC or laptop for transferring the data of pen drive to another pen drive or any other USB device. This Projects shows the methodology that can be used to do data communication i.e., (data transfer) between two USB mass Storage devices by using friendly ARM microcontroller and touch screen.

Keywords: USB Device, data transfer, Friendly ARM, Touch Screen, S3C2440A microcontroller.

Introduction

A USB storage device is that being a peripheral device, it needs a host, usually a Computer to initiate and mediate communications between two USB storage devices or other peripheral devices.

This project has eliminated the use of computer for transferring data between them. Data transfer is done by using ARM9 module S3C2440 [1]. The pen drives are connected to USB module. The communication between two pen drive is done by using ARM9 modules which are supports File Transfer Protocol (FTP). To transfer the data between these modules pen drive with data is connected to USB support. This project consists of touch screen for the user to control data transfer between two USB devices. A user has to enter the password to access the data in pen drive, after entering password it has two options in it one is view and send. By pressing view user can view data present in pen drive and by using send option user can send the data to other pen drive.

Existing Method

Nowadays the transfer of data between two pc's can be done with either net accesses or LAN network or using USB Storage device.

- Transferring data to any workstation using a flash drive needs the use of Laptop or Desktop.
- Transferring data between Two PC is not secured with help of net access.

Pen drive is an external device which stores information and helps us to transfer files or folders from one computer to another, they are also called USB flash drive.

A USB flash drive [2] is a data storage device that includes flash memory with an integrated Universal Serial Bus (USB) interface. USB flash drives are typically removable and rewritable, and physically much smaller than an optical disc.

To copy data from one pen drive to another pen drive, a third medium or master device is needed since pen drives are USB slave device, USB slave devices cannot communicate directly with USB slave devices.

The Third medium or master device can be:

- Computer or laptop that contains a CPU and Operating System which helps to initiates data transfer between these two devices.
- A master device called USB Host Controller with a built in CPU for handling the USB protocol and a firmware loaded in it, to handle the file systems for transferring data between these two devices.

Another medium can be a wireless device controller like Bluetooth or Wi-Fi to create a link between these two active devices for sending or receiving data from one device to another.

2. Literature Review

A lot of work has been done in the field of embedded systems to eliminate the use of computer or laptop for the

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purpose of just copying data from one USB device to other. The basic principle of all the methods however involves the use of any third medium in between these two USB devices.

Tiwari&Motghare [3] have suggested the methodology and mechanism for transferring data from one USB device to another USB device. This project contains VDIP2 module along with the VNC1L [4] chip incorporated on it for the task of data transfer between two USB devices.VNC1L chip runs on different application oriented firmware, out of which VDFC firmware is used to connect two USB devices to VDIP2 module, thus it acts as a USB host controller. USART communication of ATmega16 microcontroller (monitor) to control/command VDIP2 module has been used. Here, monitor acts as a master and VNC1L as a slave. The commands are sent to the module by the master via communication channel. The mode of communication can be chosen from UART, SPI or FIFO. UART is used here as a mode of communication between monitor and the module.

The limitation of the device is that it can only be used for the pen drives up to max limit of **2 GB capacity**. The detailed description about VDIP2 and VNC1L can be found [4].

Gawali& Kale [5] proposed a method for transferring the data between two Pen drives;the project enables data sharing between mobiles and pen drive directly without using of computer or laptop. The projectcontains a microcontroller ARM 7, USB controller device VNCIL [4] to interface two pen drives up to **2 GB only**. VNCIL IC forms a bridge between two USB devices and ARM7 microcontroller.In the above Project, a user has to insert the first pen drive in the master USB terminal. Then the ARM controller reads the data from pen drive using SPI protocol and display contents list on 20*4 LCD. After this a user needs to put another pen drive in slave USB terminal. The ARM controller reads the data of this pen drive as well and displays the contents on 20*4 LCD. From the menu screen the user can select/copy/cut/paste the data/files from the master pen drive to the slave pen drive using matrix keyboard.

Future plans of the above discussed project are to use touch screen in place of matrix keypad and LCD.

Tripathy& Sharma [6] described an approach to use Bluetooth technology to transfer data between two USB devices. The projecttransfers data between two pen drives or from mobile phone to pen drive with implanting or embedding small blue-tooth device on the pen drive itself.
The project consists of Bluetooth as a communicating device with the other Bluetooth enabled device to build a path defined by ISM band and connect it to transfer the data in the pen drive. The Bluetooth of a laptop or cell phone will find the Bluetooth zone of that attached flash drive and auto connects with it. In this project **there is lack of LCD** in the Bluetooth enabled pen drive. After the final setup of the connection, the microcontroller along with the Bluetooth chip initiates the sharing of data between these two USB devices.

For the purpose of read and write operation, the project uses a small CMOS battery to give the electric charge to the transistors of the flash drives and the controller to work properly.

Main limitation of this proposed method is the **data transfer speed which is 1.5 Mb/s**.
Future plans are to **interface Display Screen [7]** in the pen drive and increase the transfer speed.

Block Diagram

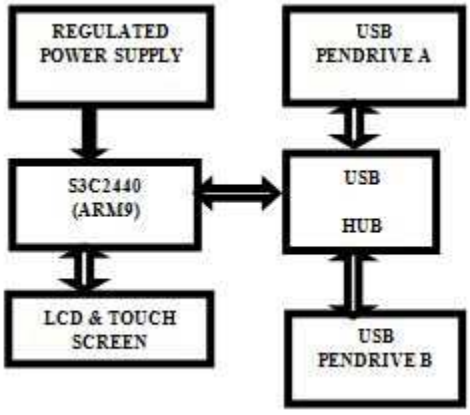

Figure 3 S3C2440 ARM

S3C2440AMICROCONTROLLER [1]

SAMSUNG's S3C2440A 16/32-bit RISC microprocessor. SAMSUNG's S3C2440A is designed to provide hand-held devices and general applications with low-power, and high-performance microcontroller solution in small die size. To reduce total system cost, the S3C2440A includes the following components.
The S3C2440A is developed with ARM920T core, 0.13um CMOS standard cells and a memory complier. Its low power, simple, elegant and fully static design is particularly suitable for cost- and power-sensitive applications. It adopts a new bus architecture known as

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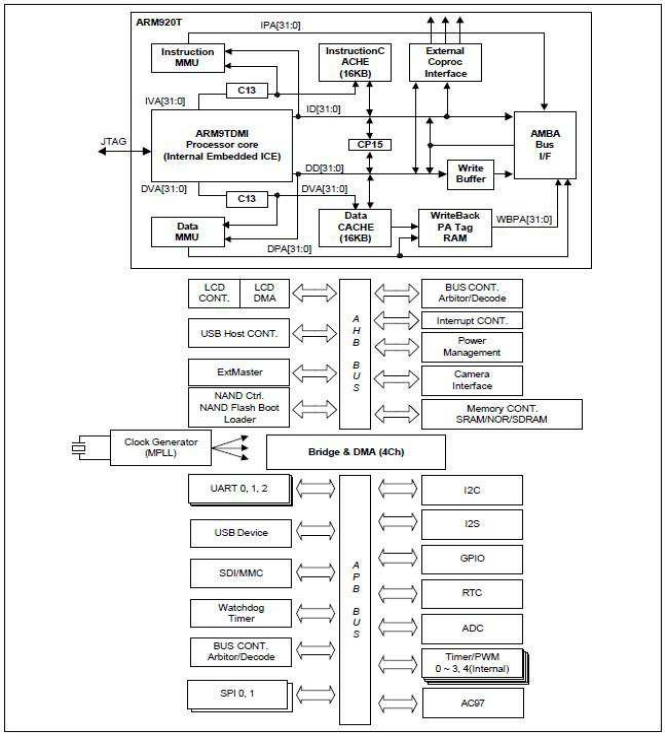
Advanced Micro controller Bus Architecture (AMBA). The S3C2440A offers outstanding features with its CPU core, a 16/32-bit ARM920T RISC processor designed by Advanced RISC Machines, Ltd. The ARM920T implements MMU, AMBA BUS, and Harvard cache architecture with separate 16KB instruction and 16KB data caches, each with an 8-word line length. By providing a complete set of common system peripherals, the S3C2440A minimizes overall system costs and eliminates the need to configure additional components.

The integrated on-chip functions that are described in this document include:

- Around 1.2V internal, 1.8V/2.5V/3.3V memory, 3.3V external I/O microprocessor with 16KB I-Cache/16KB D-Cache/MMU
- External memory controller (SDRAM Control and Chip Select logic)
- LCD controller (up to 4K colour STN and 256K colour TFT) with LCD-dedicated DMA
- 4-ch DMA controllers with external request pins
- 3-ch UARTs (IrDA1.0, 64-Byte TX FIFO, and 64-Byte Rx FIFO)
- 2-ch SPI
- IIC bus interface (multi-master support)
- IIS Audio CODEC interface
- AC'97 CODEC interface
- SD Host interface version 1.0 & MMC Protocol version 2.11 compatible
- 2-ch USB Host controller / 1-ch USB Device controller (version 1.1)
- 4-ch PWM timers / 1-ch Internal timer / Watch Dog Timer
- 8-ch 10-bit ADC and Touch screen interface
- RTC with calendar function
- Camera interface (Max. 4096 x 4096 pixels input support. 2048 x 2048 pixel input support for scaling)
- 130 General Purpose I/O ports / 24-ch external interrupt source

Power control: Normal, Slow, Idle and Sleep mode



On-chip clock generator with PLL
Fig. 3.1S3C2440 A Microcontroller

Project Operation

The main intention of this system is to transfer the data from one Pen Drive to other. The transfer of data without PC makes use embedded board which consumes less power. The advanced micro controller like **S3C2440** is a Samsung company's microcontroller which is based on the structure of ARM 920T family. This microcontroller works on a voltage of **+1.8V DC** and at an operating frequency of **400 MHz,** The maximum frequency up to which this micro controller can work is **533 MHz**

We can get **S3C2440** microcontroller individually or we can get it in the form of **FRIENDLY ARM** board can call it as **MINI 2440** board.

In order to work with **ARM 9** micro controllers we require 3 things. They are as follows.

1. Boot Loader
2. Kernel
3. Root File System

Boot loader [9]

The main functionality of boot loader is to initialize all the devices that are present on the mother board of **MINI 2440** and at the same time to find out whether any problem or any other fault is there in the devices that are present on that mother board of **MINI 2440**.

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The other feature of the boot loader is to find out what are the different operating systems that are present in the standard storage devices and to show it on the display device so that user can select between the operating systems.

One other feature of the boot loader is to load operating system related files byte by byte into the temporary memory like RAM. In our current project we are using boot loader **Super vivi** which is **MINI 2440** specific.

Kernel

The core part of an operating system is kernel. Operating system performs its functionalities like File management, Process management, Memory management, Network management and Interrupt management with the help of the kernel only. Kernel holds the device related drivers that are present on the motherboard. **Friendly ARM** board supports for operating systems like **Symbian, Android, Embedded Linux, and Win CE**. In all these operating systems **embedded Linux** provides high security to drivers and files, so in our current project we are making use of kernel of **embedded Linux.** In this kernel device related drivers that are present on the mother board of friendly arm, loads all the necessary files automatically.

Root File System [10]

File system tells how the files are arranged in the internal standard storage devices. In **embedded Linux**, kernel treats everything as a file even the input and output devices also. In **embedded Linux**, **Root** is the parent directory it contains other sub directories like **dev, lib, home, bin ,sbin , media, mnt , temp , proc , etc.** All the internal devices that are present on the motherboard of **MINI 2440** will get their corresponding drivers when we load **Embedded Linux** kernel. But these device drivers require micro controller related header files and some other header files which will be present in the **lib** directory which is present in the **root** directory**.** So it is compulsorily we need to load the Root File System. **MINI 2440** specific Root File System is **Root Qtopia.**

The essential programs that are required in order to work with **MINI 2440** are Boot loader, **Embedded Linux** related Kernel, Root File System is loaded into the **NOR** flash which is present on the MINI 2440 board itself. The program that is related with the application is loaded into **NAND** flash which is also present on the **MINI 2440** board itself. By using boot strap switch that is present on the MINI 2440 helps the user to select either **NOR** or **NAND** flash. After that by using **DNW** tool we can load Boot loader, **Embedded Linux** kernel and Root File System into **NOR** flash by using USB cable and the application related program into **NAND** flash.

After loading everything into MINI 2440 board, it starts working based on the application program that we have loaded into the **NAND** flash.

The two pen drives are connected to ARM9 board through USB hub. The data which has to be transferred is placed in one pen drive. The USB hub is connected to ARM9 board through USB device. Touch screen display is also connected to the board. The file can be selected by pressing the select icon on the display. After selecting the file, ARM9 board reads the file from the pen drive and store it to internal memory. After that the controller transfers the selected file to another pen drive by pressing send option on LCD. The options are present on LCD like send, delete, refresh, and exit. By pressing the icon on LCD particular action is performed. In this way we can transfer the files from one Pen Drive to another without using PC.

The Main Features of the Project

1) The project work includes touch screen in place of graphical screen and key pad for selecting the data which makes human work easier by drag and drop method.
2) Data can be transferred fromfirst pen drive to second or second pen driveto first.
3) Data transferring speed is much faster up to 12 Mb/s
4) Power consumption is also less.
5) The Project can not only transfer the data but also can format, delete and copy any particular data from one pen drive to other or vice versa.

Results and Discussions

The project **"**Research on Friendly Arm for Data Transfer between Two USB Devices without Computer**"**has been successfully designed and tested. It has been developed by integrating features of all the hardware components and software used. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced ARM9 board and with the help of growing technology the project has been successfully implemented.

Applications

1) USB flash Drive Interface
2) Digital Camera Backup Interface
3) USB Data logger
4) USB flash Drive and Audio playback

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Limitations

We can see the files of any format on the screen but we cannot open it. We can only transfer it to other UB disk and vice versa.

In now-a-days, data transferring securely is going to be a very big task to the confidential people (like business, government people) due to the hackers. The data transfer between confidential people is a challenging task.

The data can be transferred through internet (email), server etc., but we have the problems of hackers and virus. In order to provide the security to data transfer this proposed project will help a lot by using the devices like ARM9 processor, and pen drive without using any PC.

Here we have an option for selecting folders to transfer the data in between pen drives. But we are not opening, editing any documents due to the problem of software's (word, pdf, notepad etc.) which is not available presently in ARM9.

In future we may overcome this limitation with growing technology. We may read, edit any data by installing the software's which support's for opening the document like MS word, notepad etc. This may help for us to send the data to the pen drives without interacting PC every time for any modifications.

Future Scope

- Data can be collected on smart phone along with the base stations.
- Various other industrial sensors can be used for industrial parameter monitoring [6].
- This project can find application in domestic agricultural field. In civilian domain, future work can be used to ensure faithful irrigation of farm field, since we have the option of finding out moisture level of soil in a particular area. [7].

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