

**CENG 491 – COMPUTER ENGINEERING
DESIGN I**

REQUIREMENT ANALYSIS REPORT

'BLUEPOST'

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1. PROJECT SCOPE AND DEFINITION

1.1 PROJECT TITLE

Our project title is “BluePost”.

1.2 PROBLEM DEFINITION

As you all know, paper posters are very common in daily life because of the fact that they are inexpensive and easy to install. However, they lead to some disadvantages as well. Most important of all, they do not provide the opportunity to make a change in the content of the poster once it is installed. In addition, it is possible for a person to forget about the details of the event unless the information is noted. Besides, it is not easy to inform other people about the event when paper posters are used. Furthermore, paper posters are easy to damage. To illustrate, when a person rips the poster, the information is lost and it is costly to bring it back. So the thought of using digital posters for everyday use arises.

1.3 PROJECT SCOPE

We defined the functionalities of our system by internet search and a questionnaire about the desires and needs of the users, which can be found in the appendix. We believe that with the functionalities we will develop all the undesirable effects of using traditional posters will come to an end by means of the “BLUEPOST PROJECT” that we will develop. With the help of this project, it will be much easier to update the content of a poster since it will be a computer based image which can be uploaded with just a few clicks. Since the details of an event and the image file itself will be sent to a device via interactive bluetooth, the information can be stored until the owner of the device deletes the message. In addition, s/he will be able to send the message to

other people easily using bluetooth technology. It is obvious that the disadvantage about ripping the posters will be prevented with the help of BLUEPOST.

As for the technical details about the project, we will design and implement the hardware and software required to make an LCD monitor or television into a digital poster with bluetooth capabilities. Our system will be connected to a bluetooth converter card and a monitor via VGA. We will develop the necessary software for administrative tasks like uploading poster images and event data. Users will be able to see the still poster image on the monitor and follow a procedure on their Bluetooth devices in order to get poster event data as a calendar event (iCal VEVENT). The image itself may be sent to the Bluetooth devices as well. Moreover, the users will be given the opportunity to send image files via a Bluetooth device to be displayed on the monitor. In that case, the users will also send a file containing the details of the event via bluetooth.

The project that we will develop may easily be used in places where all kinds of social and cultural activities are held including cinemas, concerts, theaters etc. Also, this project can be used for educational purposes. As an illustration, there are a lot of student clubs that give seminars and meetings. With the help of our project, it will be much easier for the students to become aware of these activities and share the information with each other. The project will also be used for commercial purposes. For example, when there is a campaign in some product, the consumers will easily be informed about it. We believe that as the project evolves, it will be much more widely used in different areas.

Our project consists of 3 basic parts:

- 1- forming a movie on LCD/TV screen,
- 2- integrating bluetooth part into the board,
- 3- sending message to the other bluetooth receivers.

Creating a video signal on the screen is the hardest part of our project. For achieving this, we should obtain synchronization through our code. We know that video image is sent as frames to

the screen and transformation of every frame line should be done in equal time slices. For achieving an active video on LCD, we should first solve the problem of resolution. Increasing resolution is necessary for active movies. With this aim, we should give great importance to the coding part of the project. As stated before, every line should be transformed in a specified time period and saturation is identified according to the number of pixels that we show during this period. In other words, only x- axis of the screen has effect on saturation and we should maximize the pixels in the x- axis for obtaining an action movie.

For the bluetooth part of our project, the first thing to deal with is the integration of bluetooth device into the XSA board. After this integration, information will be sent in packages in endian format. Transformation of message will be done from master (XSA board) to slaves (telephones with bluetooth capability) by sharing the same channel.

Bluetooth mechanism uses host controller interface (HIC) for basic commands like sending data, receiving data etc. As a result, our modified HIC will be created for providing bluetooth with the necessary hardware structure. Besides, by means of the bluetooth system, the user will be able to send an image to be displayed on the monitor.

2. MARKET OBSERVATION

Market observation is one of the key concepts in order to understand what the system is. With this aim in mind, we made some literature survey through the internet. Below are the explanations about some examples in the digital poster world market.

2.1 HYPERTAG

Hypertag is a new way of allowing people to access relevant information and content on a mobile phone or PDA (e.g. Palm Pilots or Pocket PCs) directly from objects such as advertising panels, marketing or exhibition displays. Consumers use their mobile device to interact with a

small electronic tag attached to the display to download content. This could be any form of digital content including videos, music, vouchers, a prompt for an important event, games, live information or contact information. Currently Hypertag is focused on delivering solutions in two distinct markets.

2.1.1 OUT-OF-HOME ADVERTISING

Using Bluetooth and infra-red technology Hypertag offers a range of solutions for the advertising market. This includes outdoor poster advertising, promotional events and experiential marketing. Hypertag allows brands to improve their return on investment in advertising by offering a system which generates and measures positive brand interactions.

2.1.2 INTERPRETATION GUIDES

These systems create an opportunity for visitor attractions, such as museums and galleries, to communicate with their audiences in a new way. Both solutions available for this market enable the visitor attraction to communicate more in depth information to visitors and engage them with an exhibit through the use of multimedia content. [1]

2.2 REMOTE MEDIA

Remote Media has developed a range of Digital Posters that enable traditional printed posters to be replaced forever.

The Digital Poster is available in **10.2", 17", 23", 32", 37", 42", 46"** and **55"** sizes and combines the very latest High Brightness LCD Displays, an embedded Remote Media Player and updating using Wireless, GPRS and 3G communications.

Remote Media's Digital Posters are available in both a custom designed housing and in a standard aluminium housing. Digital Posters offer the perfect option for customers wishing to integrate the Digital Signage into their own environment with options for custom coloured housings, standard VESA brackets for wall and ceiling mounting. An optional set of 'L Shape'

brackets enable the Digital Poster to be install behind an opening or into a third party housing.

All of Remote Media's Digital Posters can be installed in both **Portrait** and **Landscape** orientations.

The Digital Poster range is available in both **Standalone** and **Network** versions. The standalone version enables Still Images to be uploaded and changed using a standard USB Memory Stick. The network edition enables, Still Images, Video, Web Pages and Macromedia Flash animations to be updated via Wireless, 3G and Fixed Network communications.

The Remote Media Management Software (RMMS) supplied to control your Digital Posters enables the media content to be scheduled for playback at a date and time of choice.

The RMMS enables you to pre-book when you want new images to be played and will provide you with online reports to confirm that each Digital Poster is playing your requested files.

2.3 DIGITAL POSTER BY INSTRUCTIONAL TECHNOLOGY AND ACADEMIC COMPUTING (ITAC)

The digital poster revolutionizes traditional research presentation methods by combining text, audio, video and animation. It solves problems typically associated with static paper posters, namely space and content limitations. A dome speaker system even limits audio to a particular area around that poster so as not to conflict with other nearby audio.

"The interactive digital poster allows multiple layers of information that weren't possible before," says ITAC's Megan Linos, the poster's designer. "Typically, people have all kinds of questions about the research and its applications. For example: how are related devices made? How much will they cost? Why does a biology professor want to make this motion device? All of the answers - and more - are included in the poster." [2]

Digital posters can be created exactly to the researcher's wishes and style - complex or simple - and the designers work will work with the researcher to create a customized and unique digital poster.

ITAC is considering the design of a template system similar to PowerPoint, which would allow researchers to easily plug in their own data files, interactive touch-screen capabilities, posting digital posters on the Web and easy memory key portability.

As a result of investigating the digital poster world market, we decided to add new functionalities to our system such as sending the image file to the bluetooth device users and we planned to make use of their products' properties to develop ours so that BluePost would also take place in the Digital Poster Market.

2. PROJECT SCHEDULE

We scheduled our project according to the deadlines of the phases. For the gannt chart showing the details please refer to APPENDIX A.

3. TEAM ORGANIZATION AND PROCESS MODEL

3.1 PROCESS MODEL

As process model of our project, we prefer to use 'Spiral Model'. This model couples the iterative natural of prototyping with the controlled and the systematic aspects of linear sequential model.

The Spiral Model provides us with the chance of developing software in a series of incremental releases. As a start, we design the project only on paper and develop it circuit by circuit. By the linear sequential model property of Spiral Model, at every development circuit, we study on our task regions and analyze the software design again. At every circuit, we basically deal with tasks which are requirements, planning, risk analysis, engineering and testing and customer's feedback.

By this methodology, we better understand risks at each development step of large-scale software. Technical risks are considered at every stage of the project and can be reduced before become problematic for us.

3.2 TEAM ORGANIZATION

Team Structure:

Our team has 'Democratic Decentralized (DD) Structure'. We has not got permanent team leader. The short duration task coordination is determined throughout communications among group members. Every decision is made by team consensus. Communication among team members is horizontal.

Ground Rules:

- The given responsibilities in ex-meeting date should be completed until the next meeting date.
- Every team member should checks group mail twice in a day.
- Every problem that occurs should be announced on group mail immediately.
- Emergency meetings are done according to team consensus.
- All members should present in weekly meetings.
- The member who is absent in emergency meeting should have an excuse.

4. REQUIREMENT ANALYSIS

4.1 HARDWARE REQUIREMENTS

4.1.1 XESS XSA-3S1000

In our project, the main device we are going to use is the XSA-3S1000 board. This board has many features which makes it very suitable for the purpose of our project.

Features:

XILINX Spartan-3 XC3S1000 FPGA:

The main repository of programmable logic on the board which contains 1,000,000 gates. This FPGA is suitable for high volume, I/O optimized programmable logic solutions. It supports 24 different single-ended and differential I/O standards. The memory architecture enables implementation of pipeline registers and buffers for video and wireless applications. The multipliers included in the FPGA enable simple arithmetic and math functions as well as advanced digital signal processing functions.

XILINX XC9572XL CPLD:

This is the other programmable chip the XSA board contains. It manages the interface between the PC parallel port and the rest of the board. The CPLD also configures the FPGA with a bitstream from the Flash RAM.

Oscillator:

A fixed-frequency oscillator generates the master clock for the board. This is a 100 MHz oscillator. The CPLD generates two clock signals, CLKA and CLKB. This allows CPLD to control the FPGA clocks. The CLKB signal also exists through a pin on the prototyping header. This way, it can be used as a clock to an external system connected to the board.

32 MB SDRAM:

SDRAM provides volatile data storage which is accessible by the FPGA. The contents of the SDRAM can be downloaded and uploaded. The data can be downloaded to SDRAM in files whose format can be .MCS, .EXO, .HEX, or .XES. The data in the RAM can be uploaded to a computer again in the same file formats.

This is a 16 M * 16 RAM. The SDRAM controller receives read and write requests and generates waveforms to perform these requests on the SDRAM. The controller is also responsible for refresh operations which are necessary to keep the SDRAM data valid. With pipelining enabled, read and write operations can be processed almost every clock cycle.

SDRAM is controlled by bus commands. The primary commands used to access SDRAM are read and write. With the write command, the initial address line and the data word are registered. With the read command, the initial address line is registered.

2 MB Flash:

The Flash provides non-volatile storage for data and FPGA configuration bitstreams.

The board stores its configuration in the SRAM chip, however its contents are erased each time power is removed. If a bitstream is stored in the Flash, the FPGA is reprogrammed every time power is applied.

The Flash is divided into four quadrants and each of these quadrants can hold a bitstream. However, before downloading a bitstream to the Flash, the .BIT file should be converted to a .EXO or a .MCS format by using certain commands. Multiple bitstreams can be downloaded to the flash, and switches can be used to select which one to be loaded when power is applied.

The contents of the Flash can also be uploaded to a computer. The uploaded data can be stored in several file formats like MCS, HEX, or EXO.

The Flash RAM of the board can operate in byte mode, $2M * 8$, or word mode, $1M * 16$. The FPGA can read or write to any location of the Flash where as the CPLD can only access a quadrant of the Flash.

VGA Port:

The board can send signals to display 512-color graphics on a VGA monitor through this port.

Parallel Port:

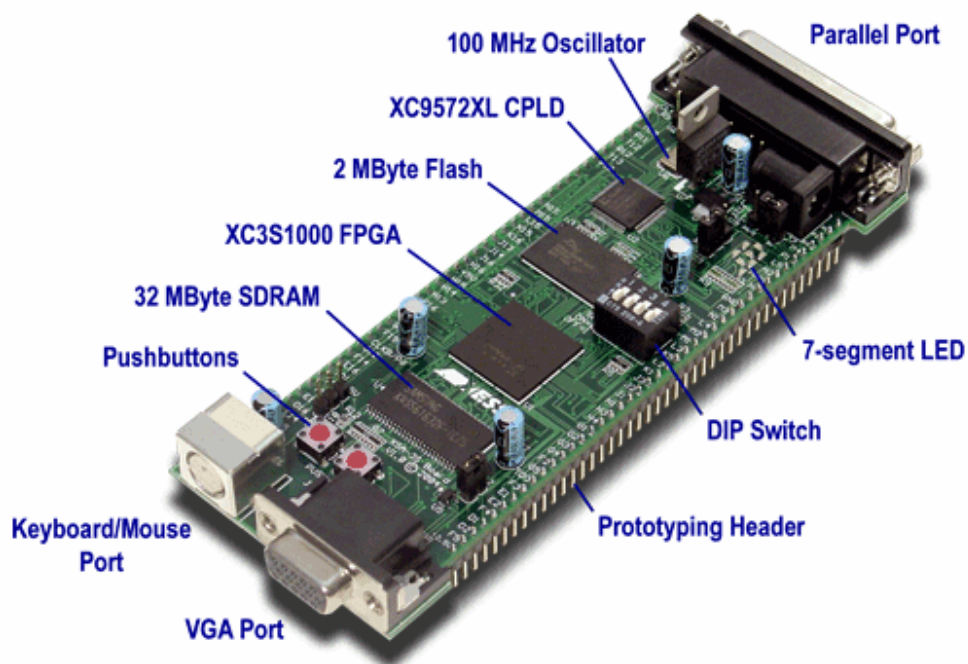
Parallel port is the main interface for passing configuration bitstreams and data to and from the board. It is the main interface for the bidirectional connection between the XSA-3S1000 board and the computer.

CPLD can be programmed to act as an interface between the FPGA and the parallel port. The CPLD is connected to the FPGA configuration pins so that it can pass bitstreams from the parallel port to the FPGA.

After the FPGA is configured with a bitstream, the CPLD switches into a mode in which the parallel port data and the status bits are connected to the FPGA. This way, the PC can send data to the FPGA over the parallel port data lines and receive data from the FPGA over the status lines. The FPGA sends data to the PC by driving logic level on certain Flash address lines which also pass through the CPLD and to the status lines of the parallel port.

Prototyping Header:

Most of the FPGA I/O pins are connected to the 84 pins located on the bottom of the board that enable connection with solderless breadboards. Specifically, a subset of the FPGA pins are connected only to the prototyping header of the board and they are free to be used in I/O operations with external systems.



Above all, the VGA port of the board plays an important role for our project. The FPGA outputs three bits, containing red, green, and blue color information, to a resistor-ladder DCA. This produces $2^3 * 2^3 * 2^3 = 512$ colors. The outputs of the DCA are then sent to a VGA monitor. The horizontal and vertical sync pulses are also generated by the FPGA.

After a research about the designs on the VGA port of the XSA-3S1000 board, we came across with three sample designs which can be beneficial for our project.

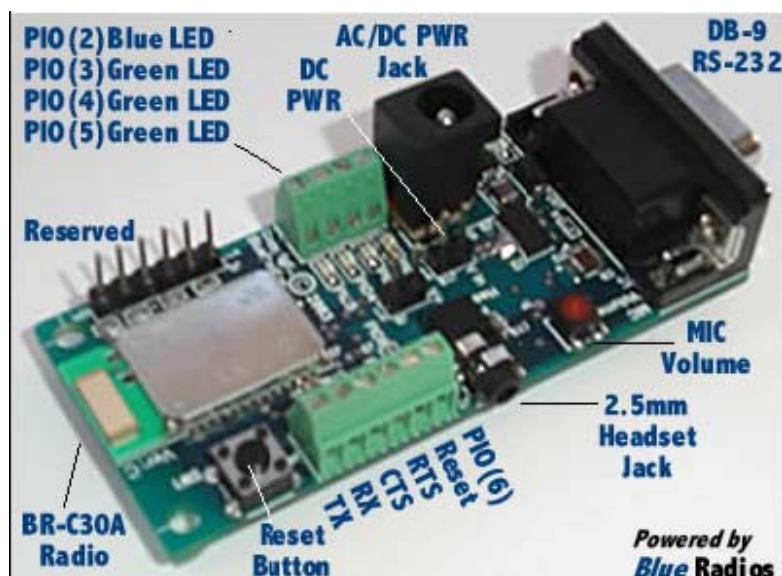
See the APPENDIX B for a brief description of some related design examples with the XSA board.

4.1.2 BLUERADIOS BR-EVAL2.0 CLIENT EVALUATION KIT

- Wireless data and voice communications board conforming to Bluetooth® v1.2
- Audio CODEC, head jack, head phones, MIC volume control.
- Conforms to FCC, CE, and the EMI standards of each country.
- Conforms to ISM 2.4GHz band Bluetooth®.
- RS-232 (DB-9), and 0-3.3Vdc logic levels
- Includes integrated software stack, profiles, and AT modem like commands.
- Embedded Bluetooth Stack Profiles Included (requires no host MCU stack):

SPP, DUN, LAN, Headset, Audio Gateway, GAP SDP, RFCOMM, and L2CAP protocols.

- Evaluation Board Accommodates both Class1 and Class2 (BR-EC29A) radio modules



Features:

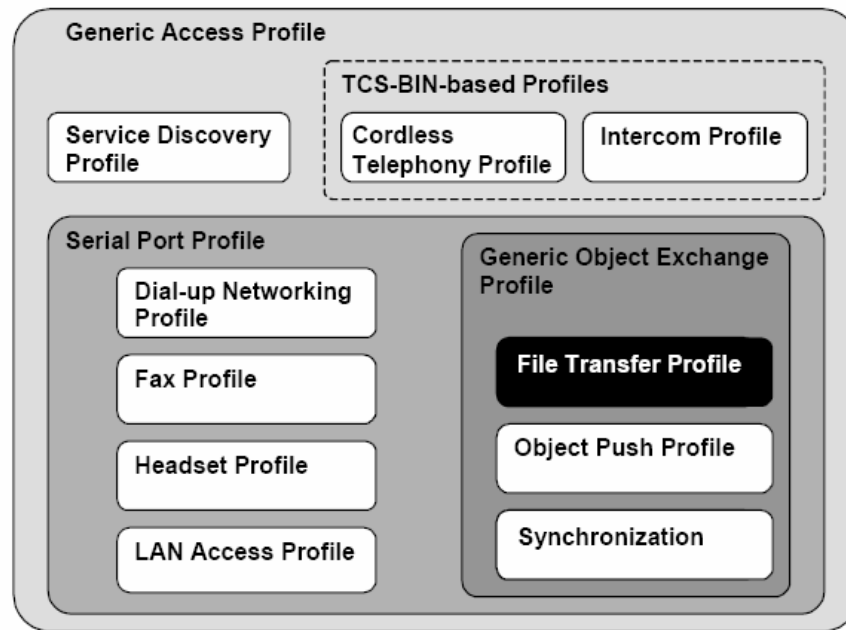
- The *BlueRadios* serial radio modems can be configured, commanded, and controlled through simple ASCII strings over the *Bluetooth* RF link or directly through the hardware serial UART.

- Dedicated PCM voice audio channel
- UART baud rate data speeds: 1200bps up to 921.6Kbps, and customized
- +100 meter (330 feet) distance
- Software adjustable transmitter power from short to long range applications
- Includes AC/DC power supply
- 13 bit linear mono CODEC
- Programmable Input Output (PIO's)
- Reset push button
- LED status: Power, Bluetooth Connection, Slave status, etc.
- 2.5mm audio jack
- Low power consumption (120mA TX, 40mA RX, 2mA idle mode, and 90uA deep sleep) radio only
- RS-232 and 3.3Vdc TTL inputs
- Self-discovery and network equipped multi-points
- Operating temperature range: -40~+70°C.
- Secure and robust communication link
- FHSS (Frequency Hopping Spread Spectrum)
- Encryption, and 16 alphanumeric Personal Identification Number (PIN)
- Error correction schemes for guaranteed packet delivery

4.1.3 BLUETOOTH PROFILE AND PROTOCOL ANALYSIS

During the analysis steps of our project, we made a wide internet search and gathered information about Bluetooth Protocols and Profiles that use these protocols and decided on what protocols and profile are suitable for our project to use.

The following figure shows the Bluetooth Wireless Technology profiles and their dependencies to other profiles.



-Bluetooth Protocols-

All the other Bluetooth profiles make use of Generic Access Profile (GAP). GAP provides the basis for all other profiles and defines a consistent means to establish a baseband link between Bluetooth enabled devices. In addition to this, GAP defines the features that must be implemented in all Bluetooth devices, Generic procedures for discovering and linking to devices and Basic user-interface terminology. Bluetooth enabled devices not conforming to any other Bluetooth profile must conform to GAP to ensure basic interoperability and co-existence.

Since we will use Bluetooth technology in order to send information about the event as a text message, after investigating the profiles in the figure, we decided that the most suitable profile for us to use is FILE TRANSFER PROFILE (FTP) and we decided to send the text message about the event to Bluetooth devices as a “.txt” file.

The scenarios covered by FTP are as follows:

1. Usage of a Bluetooth device (e.g. a notebook PC) to browse an object store (file system) of another Bluetooth device. Browsing involves viewing objects (files and folders) and navigating the folder hierarchy of another Bluetooth device. For example, one PC browsing the file system of another PC.

2. To transfer objects (files and folders) between two Bluetooth devices. For example, copying files from one PC to another PC.

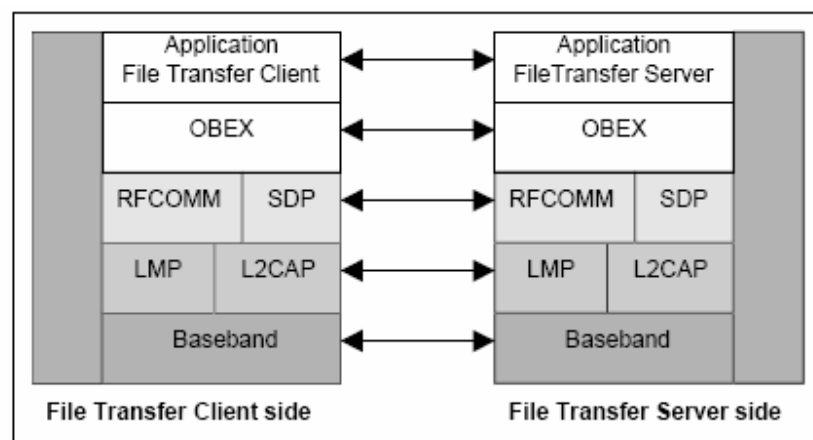
3. For a Bluetooth device to manipulate objects (files and folders) on another Bluetooth device. This includes deleting objects, and creating new folders.

We will mainly use the second scenario of the FTP by transferring the .txt file from our board to other Bluetooth devices. FTP is dependent on (i.e. uses the parts of these profiles by referencing them) Generic Object Exchange Profile (GOEP), Serial Port Profile (SPP) and Generic Access Profile (GAP).

GOEP defines the requirements for Bluetooth devices necessary for the support of the object exchange usage models. The requirements are expressed by defining the features and procedures that are required for interoperability between Bluetooth devices in the object exchange usage models. GOEP defines the interoperability requirements for the applications within the File Transfer application profile.

SPP defines the requirements for Bluetooth devices necessary for setting up emulated serial cable connections between two peer devices. The requirements are expressed in terms of services provided to applications, and by defining the features and procedures that are required for interoperability between Bluetooth devices.

The following figure shows the protocols used in FTP.



-FTP PROTOCOLS-

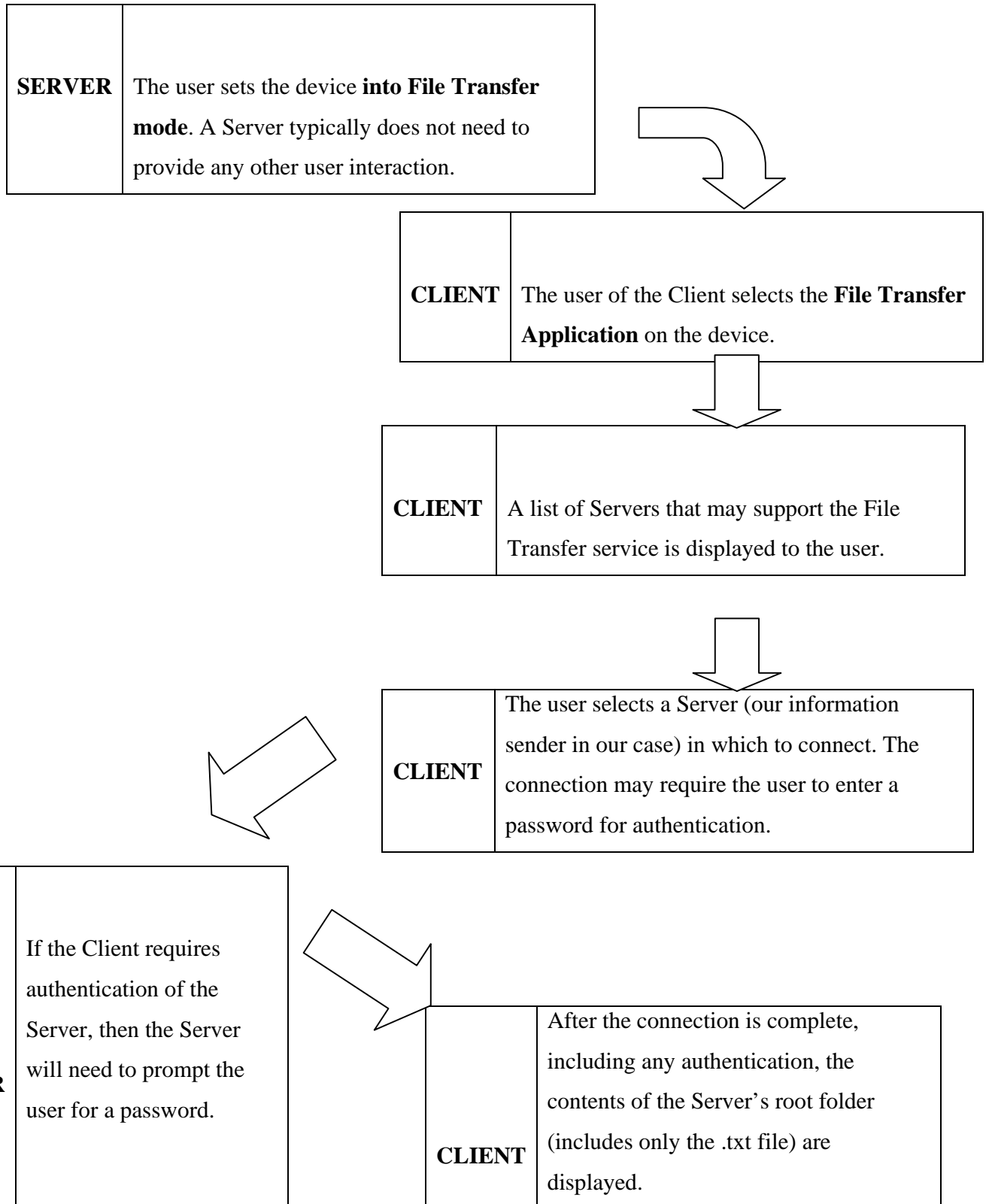
4.1.3.1. ROLES THAT WILL BE USED IN FTP

We have two main roles while transferring the .txt file between the Bluetooth Devices.

1. Client: The Client device initiates the operation, which pushes and pulls objects to and from the Server. In our project, clients are the Bluetooth devices (mobile phones, notebooks in general) whose owners want to get information (i.e. the corresponding .txt file) about an event.

2. Server: The Server device is the target remote Bluetooth device that provides an object exchange server and folder browsing capability. In our project, the unique server is the board that sends the requested information about an event as a .txt file to the corresponding clients.

The functionalities of these roles are explained in details as a use case as follows:



4.1.4 OTHER HARDWARE REQUIREMENTS

- A PC with parallel port, at least 512 MB RAM and 2 GHz Processor
- An LCD Monitor
- A mobile device with bluetooth technology
- Parallel to serial port converter

4.2 SOFTWARE REQUIREMENTS

Implementing a logic design with FPGA consists of some main steps. You can enter a description of your logic design by using a hardware design language (HDL) or a schematic editor. Then a “logical synthesizer program” transforms the HDL or the schematic diagram into a netlist which is a description of the gates in your design and how they are connected to each other. The “implementation tools” are used to map the logic gates and the interconnections to the FPGA. After this step, a program generates a bitstream which can be downloaded to a physical FPGA chip.

There are software tools which can be used to generate the bitstream for a logic design. We did research about two of these tools to learn their features.

4.2.1 XILINX ISE FOUNDATION

ISE Foundation is a complete logic design environment for all leading FPGA and CPLD products. With this tool, one can enter his/her design graphically using a schematic editor or describe it textually with the hardware description language (HDL) editor. This tool also allows describing complex finite state machines using the state diagram editor. The FPGA Express Synthesizer allows one to generate logic design for VHDL, Verilog, and ABEL HDLs. Implementation tools are used to place the design for any Spartan FPGA. The integrated simulator checks the design’s logical functions and timing. The CoreGen tools help to make digital signal processing applications. This tool works on Linux, Windows, and Solaris.

Independent surveys conducted in 2004 and 2005 have shown that ISE Foundation is preferred by most of the FPGA designers.

However there's no live technical support for this product. Support is provided by FAQ. There is no automatic software updates. Finally, this product is not free.

4.2.2 XILINX ISE WEBPACK

ISE Webpack is the only free product that can be used to program FPGA and CPLD. It offers HDL synthesis and simulation, implementation, device fitting, and JTAG programming. The latest version of ISE Webpack provides tools and features like those in ISE Foundation. Moreover it is easily upgraded to ISE Foundation. Lastly, this tool works on Linux and Windows.

Comparing the two products, we decided to use ISE Webpack since it contains similar features as ISE Foundation and provides these features at no cost. Moreover, it is easy to upgrade from ISE Webpack to ISE Foundation.

After generating the bitstream, it should be loaded to the FPGA. We are going to use XSTOOLS for this purpose. Once the bitstream is generated, a connection between the board and the computer is enabled via the parallel port of the board. Then, XSTOOLS downloads the .BIT file to the FPGA.

4.2.3 OTHER SOFTWARE REQUIREMENTS

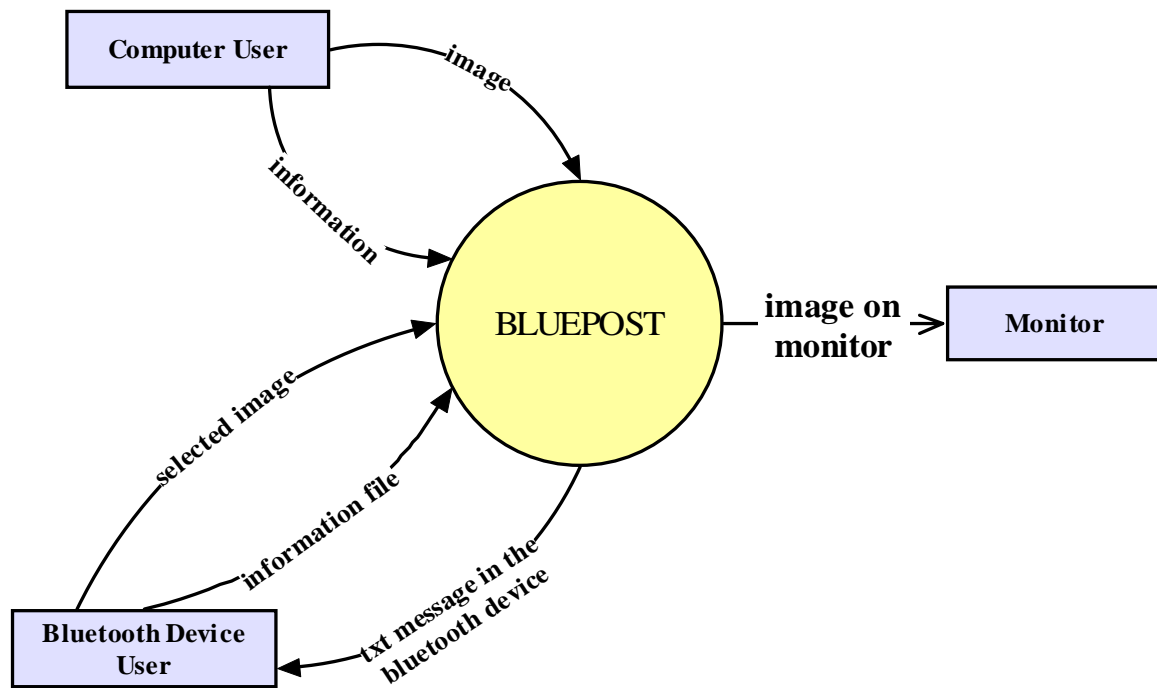
- Windows XP Operating System
- A text editor.
- An image editor.

5. MODELING

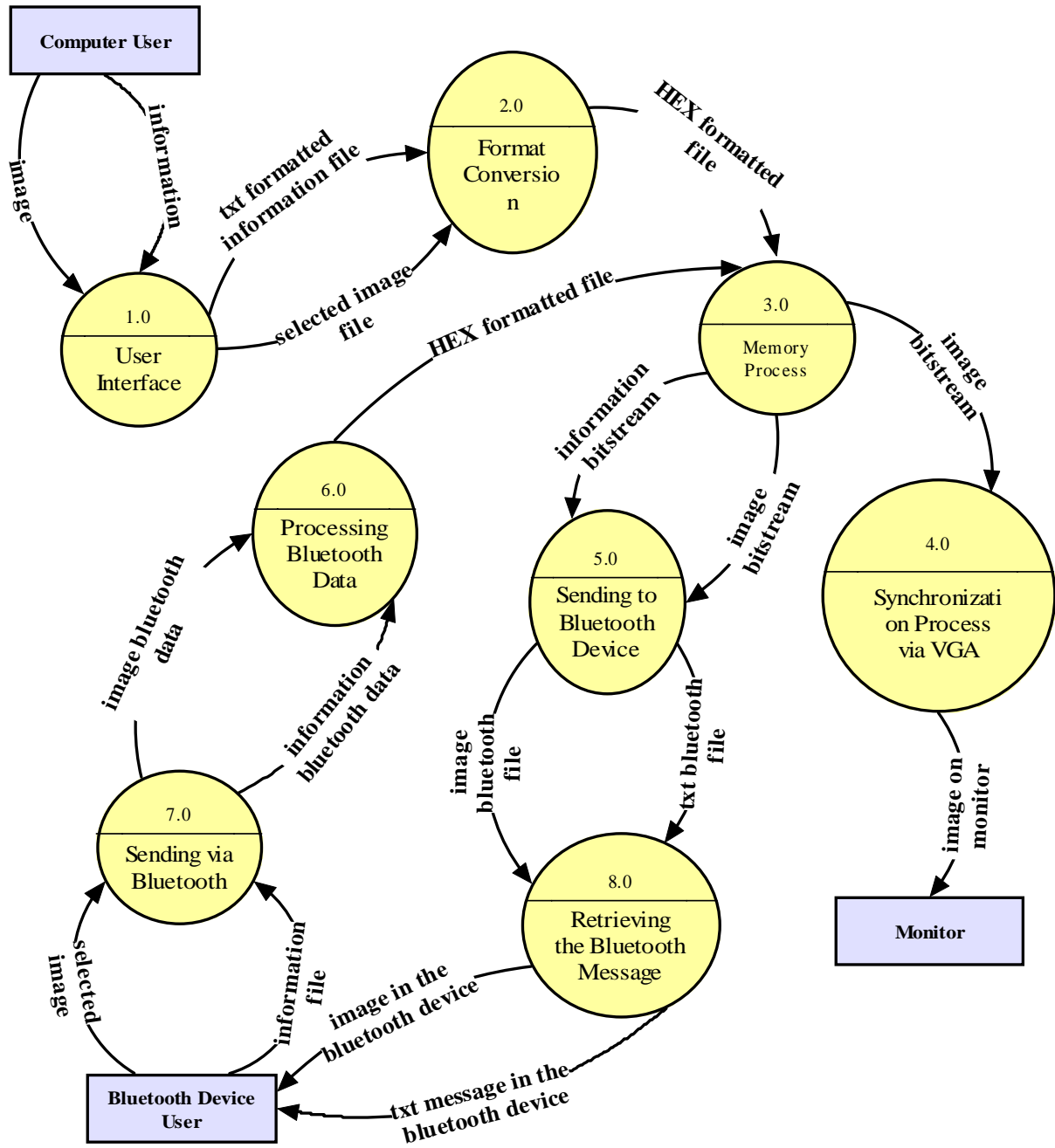
5.1 DFD and DATA DICTIONARY

5.1.1 DATA FLOW DIAGRAMS

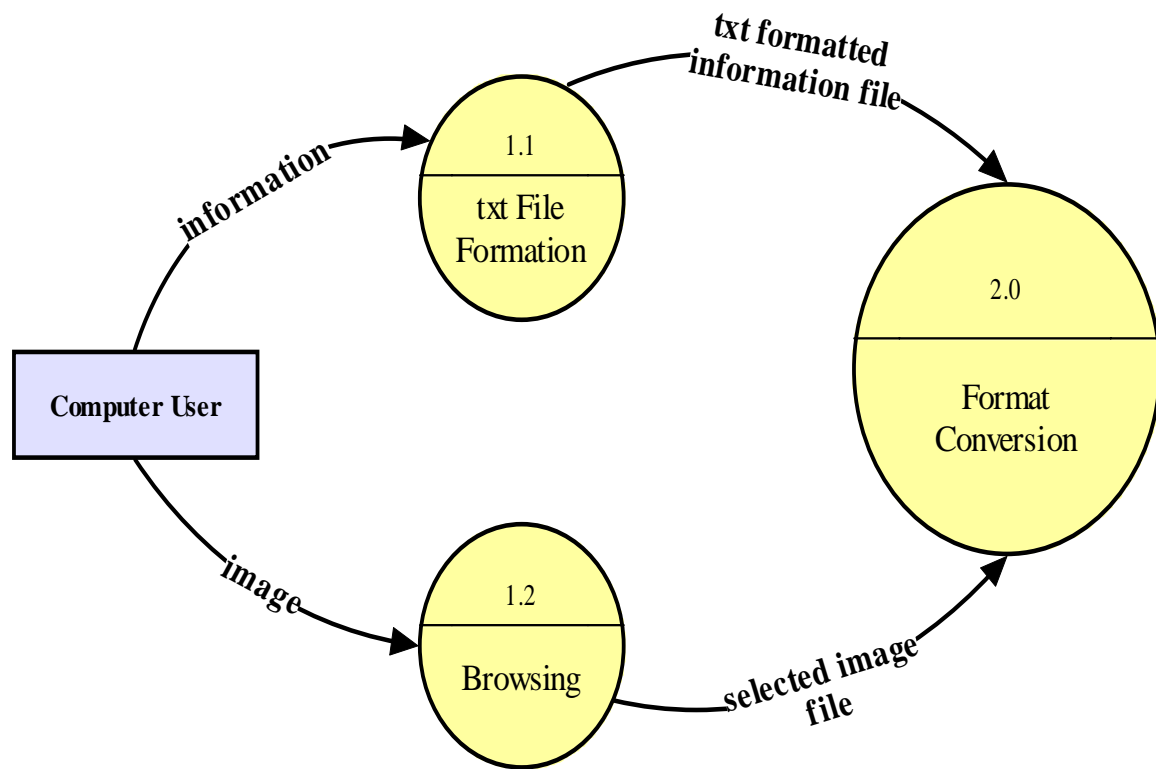
LEVEL-0:



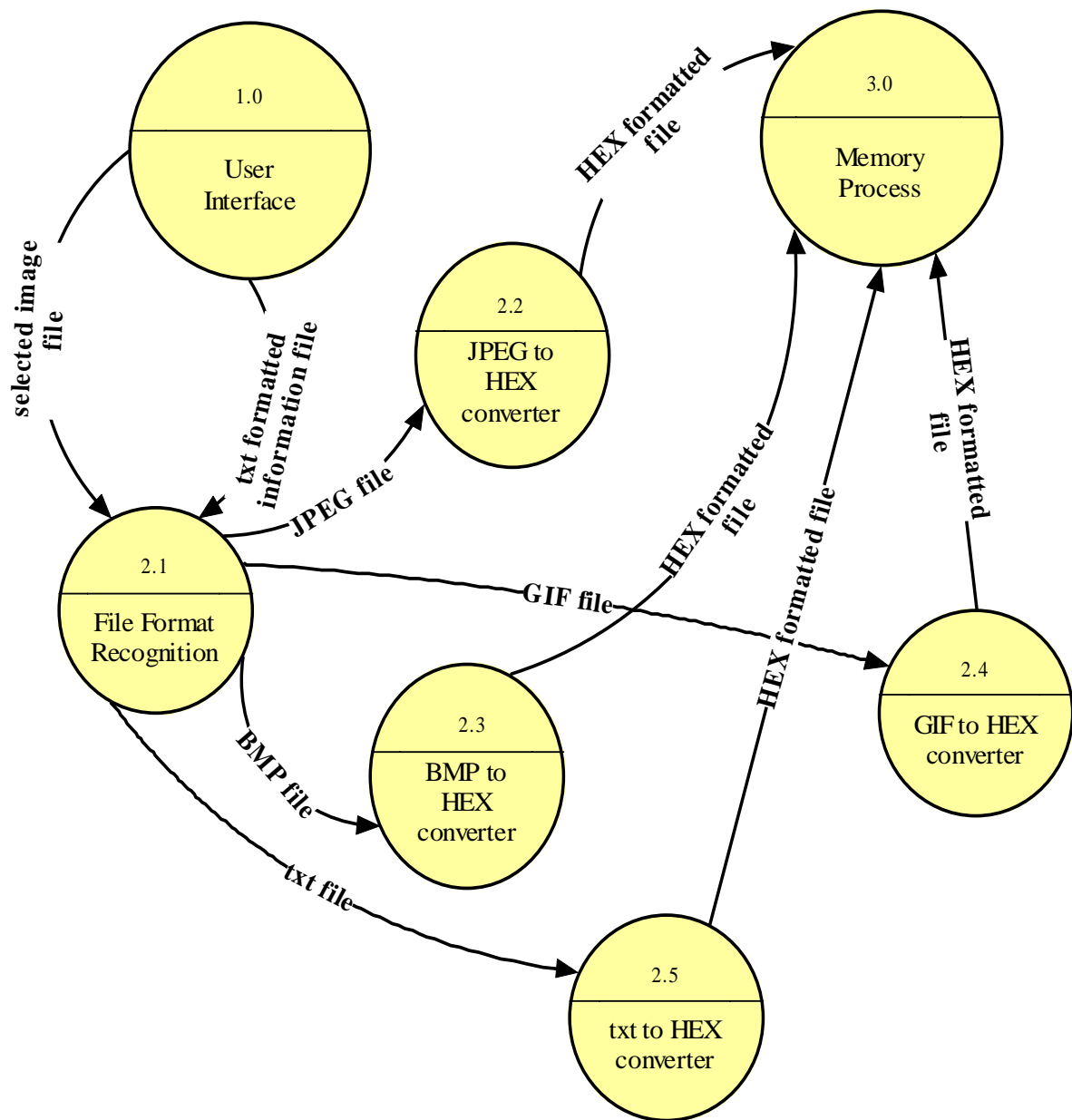
LEVEL-1:



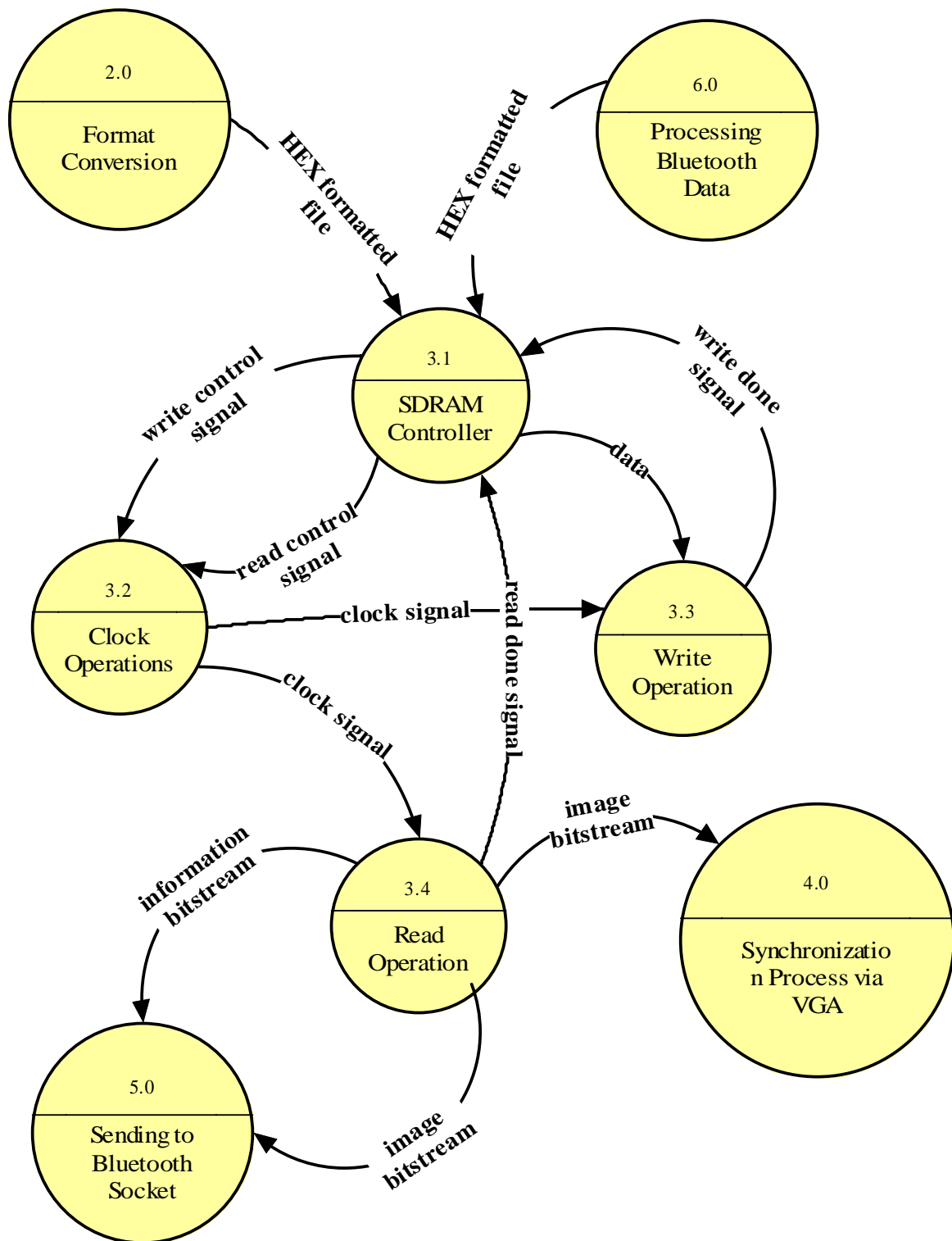
LEVEL-2 – USER INTERFACE:



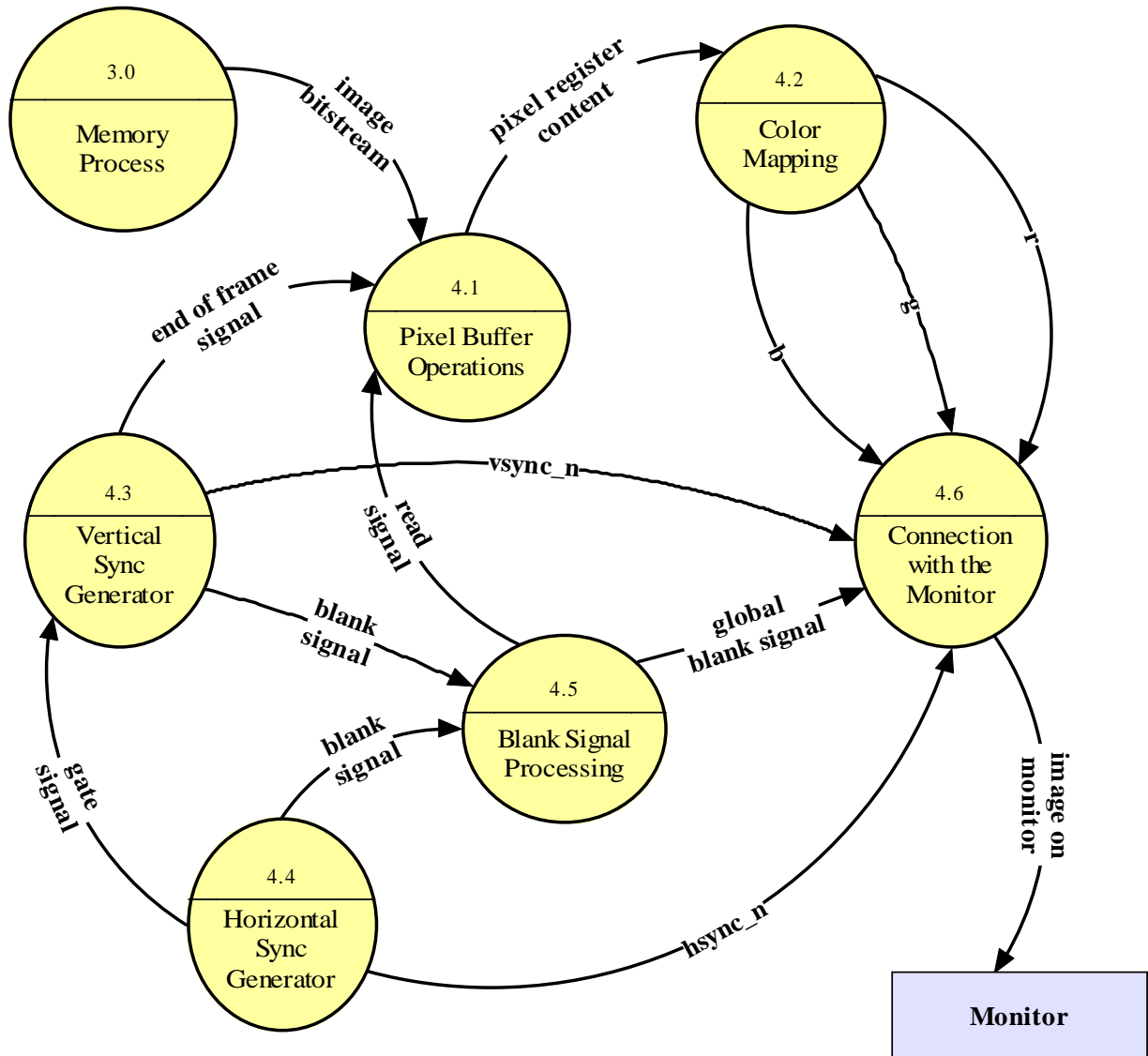
LEVEL-2 – FORMAT CONVERSION:



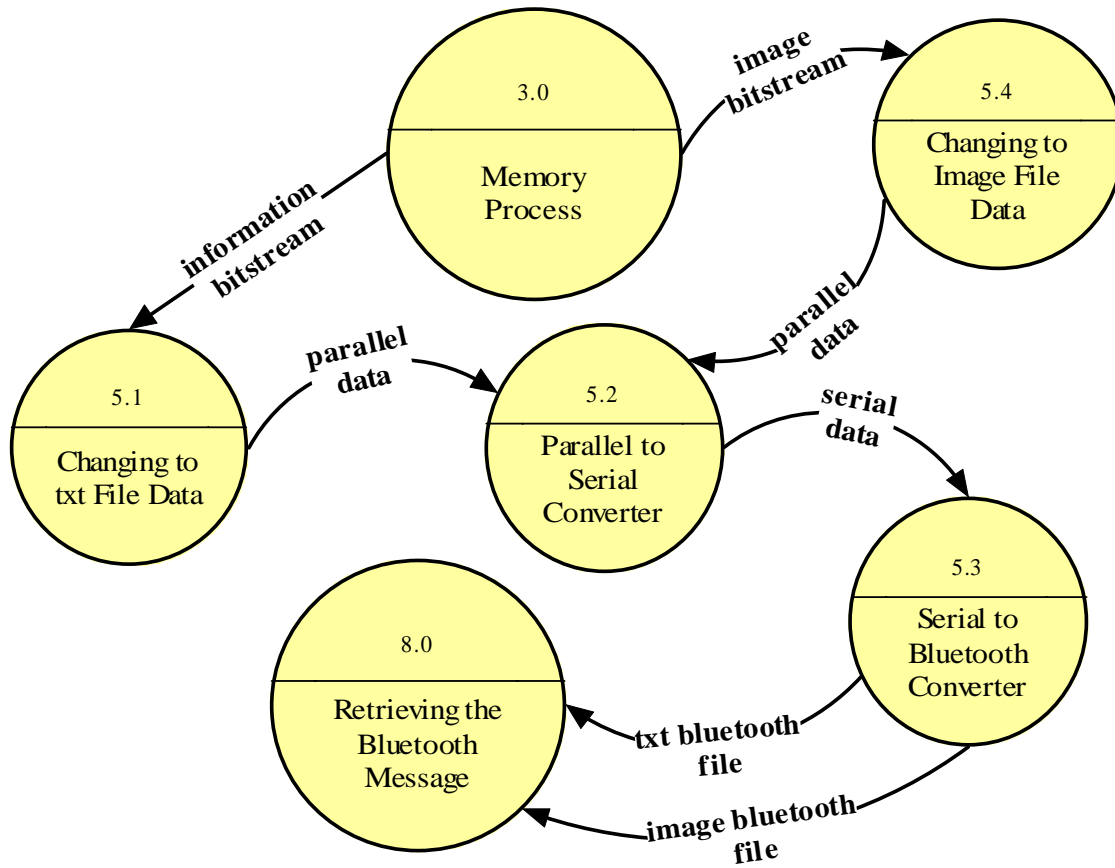
LEVEL-2 – MEMORY PROCESS:



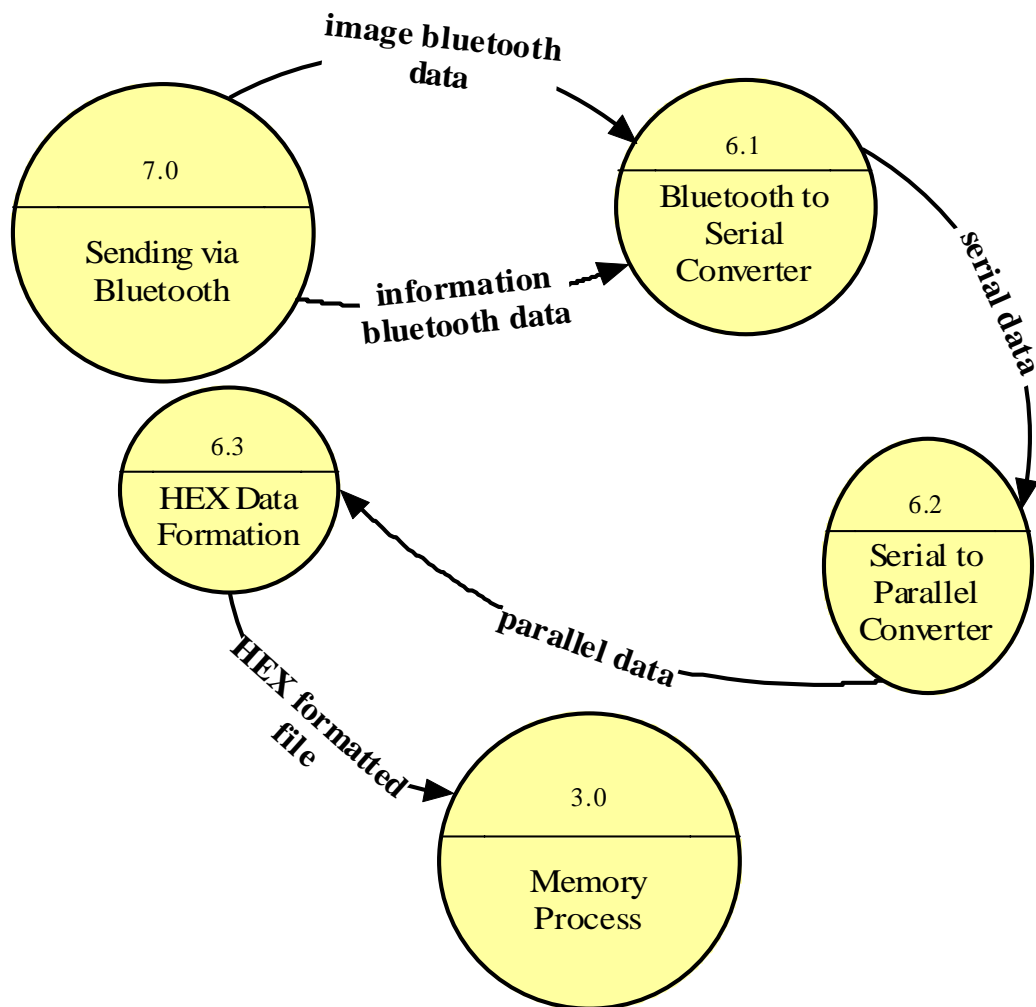
LEVEL 2 – SYNCHRONIZATION PROCESS VIA VGA:



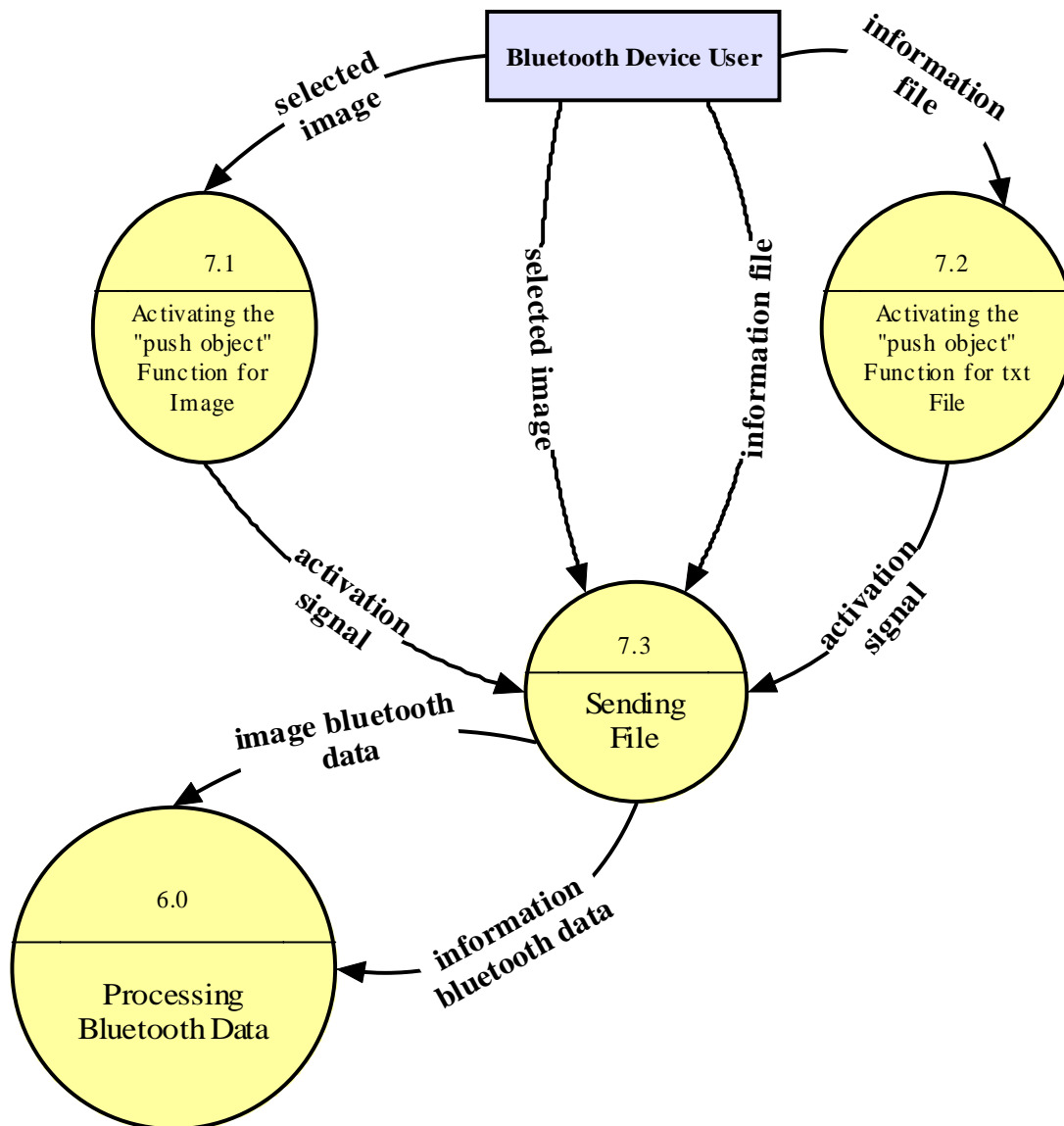
LEVEL 2 – SENDING TO BLUETOOTH SOCKET:



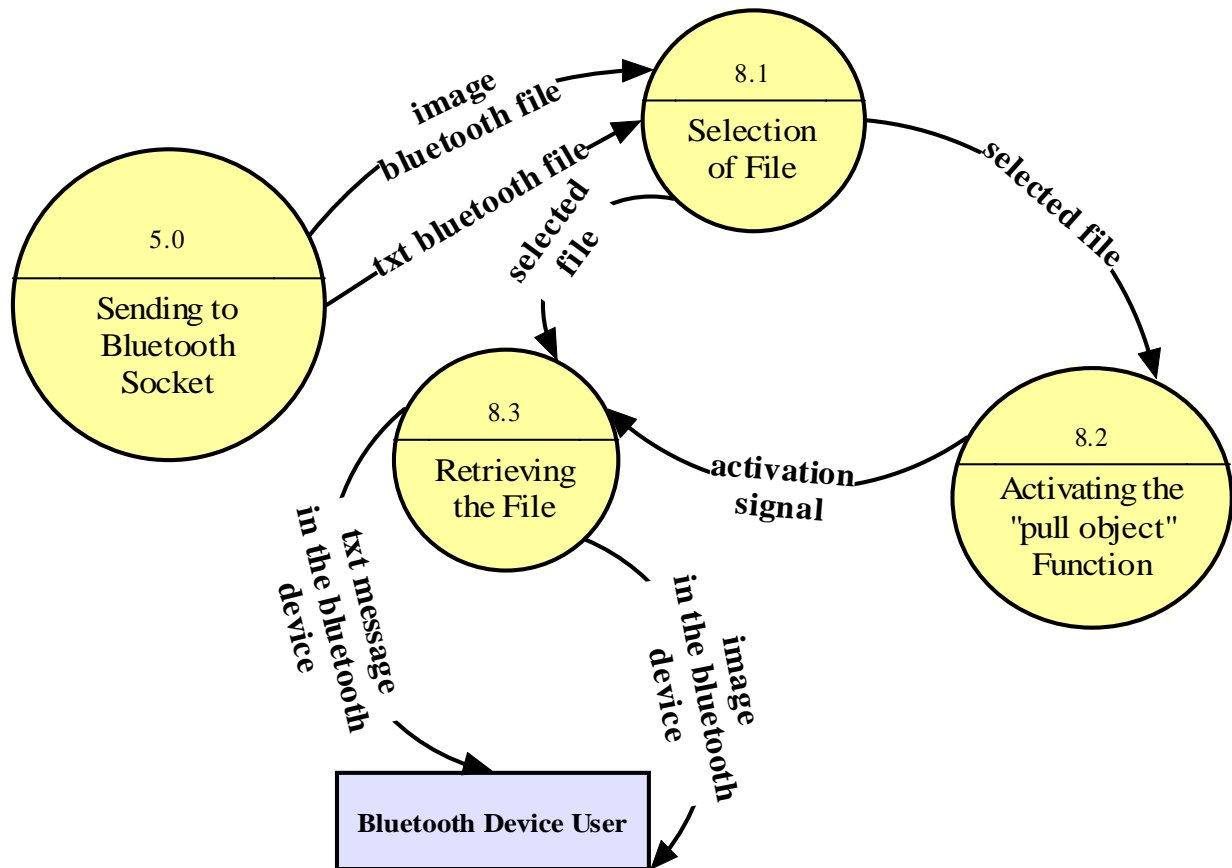
LEVEL 2 – PROCESSING BLUETOOTH DATA:



LEVEL 2 – SENDING VIA BLUETOOTH:



LEVEL 2- RETRIEVING THE BLUETOOTH MESSAGE:



5.1.2 DATA DICTIONARY

Name	r
Input to	4.6 Connection with the Monitor
Output from	4.2 Color Mapping
Description	The red color signal.

Name	g
Input to	4.6 Connection with the Monitor
Output from	4.2 Color Mapping
Description	The green color signal.

Name	b
Input to	4.6 Connection with the Monitor
Output from	4.2 Color Mapping
Description	The blue color signal.

Name	activation signal
Input to	8.3 Retrieving the File 7.3 Sending File
Output from	Activating the “pull object” function Activating the “push object” function for image Activating the “push object” function for txt file
Description	The signals indicating that the “pull object” or “push object” functions are activated in order to send or a retrieve a file via bluetooth.

Name	blank signal
Input to	4.5 Blank Signal Processing
Output from	4.3 Vertical Sync Generator 4.4 Horizontal Sync Generator
Description	The blanking signals produced by the vertical and the horizontal sync generators are combined to produce a <i>global blank signal</i> and the <i>read signal</i> .

Name	BMP file
Input to	2.3 BMP to HEX Converter
Output from	2.1 File Format Recognition
Description	The image file in bmp format that needs to be converted to HEX format before being stored in the SDRAM.

Name	clock signal
Input to	3.3 Write Operation 3.4 Read Operation
Output from	Clock operations
Description	The signals that start the reading and the writing operations of memory once a read or a write request is received.

Name	data
Input to	3.3 Write Operation
Output from	3.1 SDRAM Controller
Description	The data to be stored in the SDRAM.

Name	end of frame signal
Input to	4.1 Pixel Buffer Operations
Output from	4.3 Vertical Sync Generator
Description	The signal indicating that a new frame should be loaded to the pixel buffer.

Name	gate signal
Input to	4.3 Vertical Sync Generator
Output from	4.4 Horizontal Sync Generator
Description	The signal which is used to update the counter of the vertical sync generator correctly.

Name	GIF file
Input to	2.4 GIF to HEX Converter
Output from	2.1 File Format Recognition
Description	The image file in gif format that needs to be converted to HEX format before being stored in the SDRAM.

Name	global blank signal
Input to	4.6 Connection with the Monitor
Output from	4.5 Blank Signal Processing
Description	The signal indicates when the red, green, or blue video signals are blanked.

Name	HEX formatted file
Input to	3.0 Memory Process 3.1 SDRAM controller
Output from	2.0 Format Conversion 2.2 JPEG to HEX converter 2.3 BMP to HEX converter 2.4 GIF to HEX converter 2.5 Txt to HEX converter 6.0 Processing Bluetooth Data 6.3 HEX Data Formation
Description	The <i>selected image file</i> and the <i>information file</i> are converted to a HEX formatted file in order to be stored in the SDRAM.

Name	hsync_n
Input to	4.6 Connection with the Monitor
Output from	4.4 Horizontal Sync Generator
Description	Horizontal sync indicating the end of a scan line.

Name	information
Input to	1.0 User Interface 1.1 Txt file formation
Output from	It is an input to the system.
Description	The information entered by the user related to the event date and time.

Name	information bitstream
Input to	5.0 Sending to Bluetooth Socket 5.1 Changing to txt File Data
Output from	3.0 Memory Process 3.4 Read Operation
Description	The bitstream read from the SDRAM, ready to be processed by the bluetooth functionalities of the system.

Name	information file
Input to	7.0 Sending via Bluetooth 7.2 Activating the “push object” Function for txt File 7.3 Sending file
Output from	It is an input to the system.
Description	The txt file containing the information about the event sent via the bluetooth device.

Name	image
Input to	1.0 User Interface 1.2 Browsing
Output from	It is an input to the system.
Description	The images stored in the PC, available for selection to be displayed on the monitor.

Name	image bitstream
Input to	4.0 Synchronization Process via VGA 4.1 Pixel Buffer Operations 5.0 Sending to Bluetooth Socket 5.4 Changing to Image File Data
Output from	3.0 Memory Process 3.4 Read Operation
Description	The bitstream read from the SDRAM, ready to be processed by the VGA.

Name	image bluetooth data
Input to	6.0 Processing Bluetooth Data 6.1 Bluetooth to Serial Converter
Output from	7.0 Sending via Bluetooth 7.3 Sending File
Description	The bluetooth data received from the bluetooth device that contains the image to be displayed on the monitor.

Name	image bluetooth file
Input to	8.0 Retrieving the Bluetooth Message 8.1 Selection of File
Output from	5.0 Sending to Bluetooth Socket 5.3 Serial to Bluetooth Converter
Description	The image file that will be sent to the bluetooth devices.

Name	image in the bluetooth device
Input to	This is an output of the system.
Output from	8.0 Retrieving the Bluetooth Message 8.3 Retrieving the File
Description	The image received by the bluetooth devices.

Name	image on monitor
Input to	It is an output of the system.
Output from	4.0 Synchronization Process via VGA Connection with the monitor
Description	The image displayed on the monitor

Name	information bluetooth data
Input to	6.0 Processing Bluetooth Data 6.1 Bluetooth to Serial Converter
Output from	7.0 Sending via Bluetooth 7.3 Sending File
Description	The bluetooth data recieved from the bluetooth device containing the information about the event.

Name	JPEG file
Input to	2.2 JPEG to HEX Converter
Output from	2.1 File format Recognition
Description	The image file in jpeg format that needs to be converted to HEX format before being stored in the SDRAM.

Name	parallel data
Input to	5.2 Parallel to Serial Converter
Output from	5.1 Changing to txt File Data
Description	The serial data obtained from the bluetooth data received or the data produced by the board that needs to be converted to serial data before being sent to the bluetooth devices.

Name	pixel register content
Input to	4.2 Color Mapping
Output from	4.1 Pixel Buffer Operations
Description	The data in the pixel buffer is shifted to the pixel register and the contents of this register are processed to produce color signals.

Name	read control signal
Input to	3.2 Clock Operations
Output from	3.1 SDRAM Controller
Description	The signal indicating a read request from the memory.

Name	read done signal
Input to	3.1 SDRAM controller
Output from	3.4 Read Operation
Description	The signal shows that the current read operation is completed.

Name	read signal
Input to	4.1 Pixel Buffer Operations
Output from	4.5 Blank Signal Processing
Description	The signal which indicates when to read more data from the pixel buffer.

Name	selected file
Input to	8.2 Activating the “pull object” function
Output from	8.1 Selection of File 8.3 Retrieving the File
Description	The file ready to be sent from the board to the bluetooth device.

Name	selected image
Input to	7.0 Sending via Bluetooth 7.1 Activating the “push object” function for image 7.3 Sending File
Output from	It is an input to the system.
Description	The image file sent to the board from the bluetooth device to be displayed on the monitor.

Name	selected image file
Input to	2.0 Format Conversion 2.1 File Format Recongnition
Output from	1.0 User Interface 1.1 Browsing
Description	The images stored in the PC, available for selection to be displayed on the monitor.

Name	serial data
Input to	5.3 Serial to Bluetooth Converter 6.2 Serial to Bluetooth Converter
Output from	5.2 Parallel to Serial Converter 6.1 Bluetooth to Serial to Converter
Description	The parallel data is converted to serial data so that it can be sent to the bluetooth devices. Likewise, the bluetooth data received is converted to serial data before being converted to parallel data and processed by the board.

Name	txt bluetooth file
Input to	8.0 Retrieving the Bluetooth Message 8.1 Selection of File
Output from	5.0 Sending to Bluetooth Socket 5.3 Serial to Bluetooth Converter
Description	The txt file ready to be sent to the bluetooth devices containing information about the event.

Name	txt file
Input to	2.5 txt to HEX Converter
Output from	2.1 File Format Recognition
Description	The file in txt format which needs to be converted to HEX format before being stored in the SDRAM.

Name	txt formatted information file
Input to	2.0 Format Conversion 2.1 File Format Recognition
Output from	1.0 User Interface 1.1 Txt File Formation
Description	The file created by the information entered by the user about the details of the event.

Name	txt message in the bluetooth device
Input to	It is an output of the system.
Output from	8.0 Retrieving the Bluetooth Message 8.3 Retrieving the File
Description	The txt message received by the bluetooth devices containing details about the event.

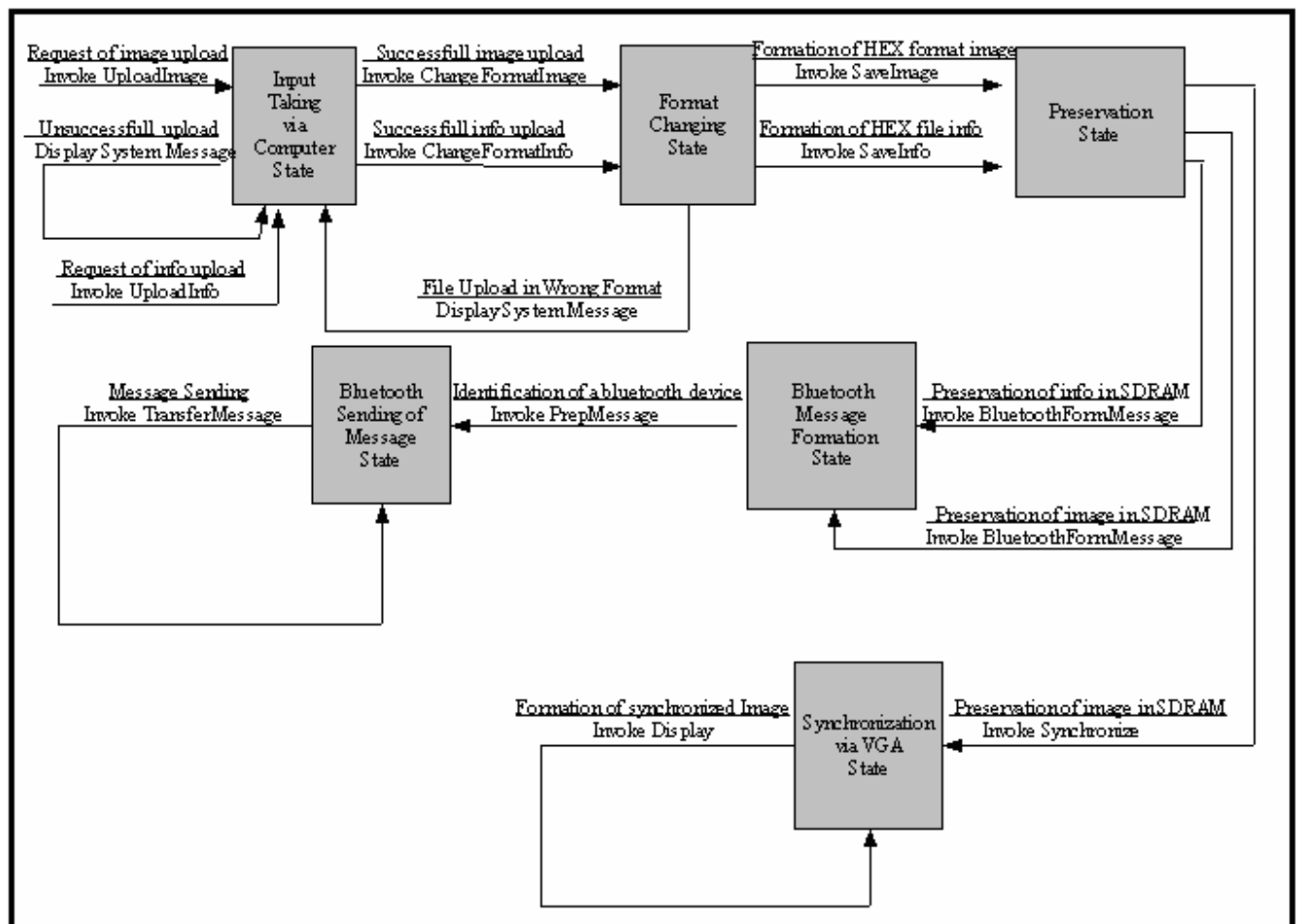
Name	vsync_c
Input to	4.6 Connection with the Monitor
Output from	4.3 Vertical Sync Generator
Description	Vertical sync indicating the end of a frame.

Name	write control signal
Input to	3.2 Clock Operations
Output from	3.1 SDRAM Controller
Description	The signal indicating the write request to the memory.

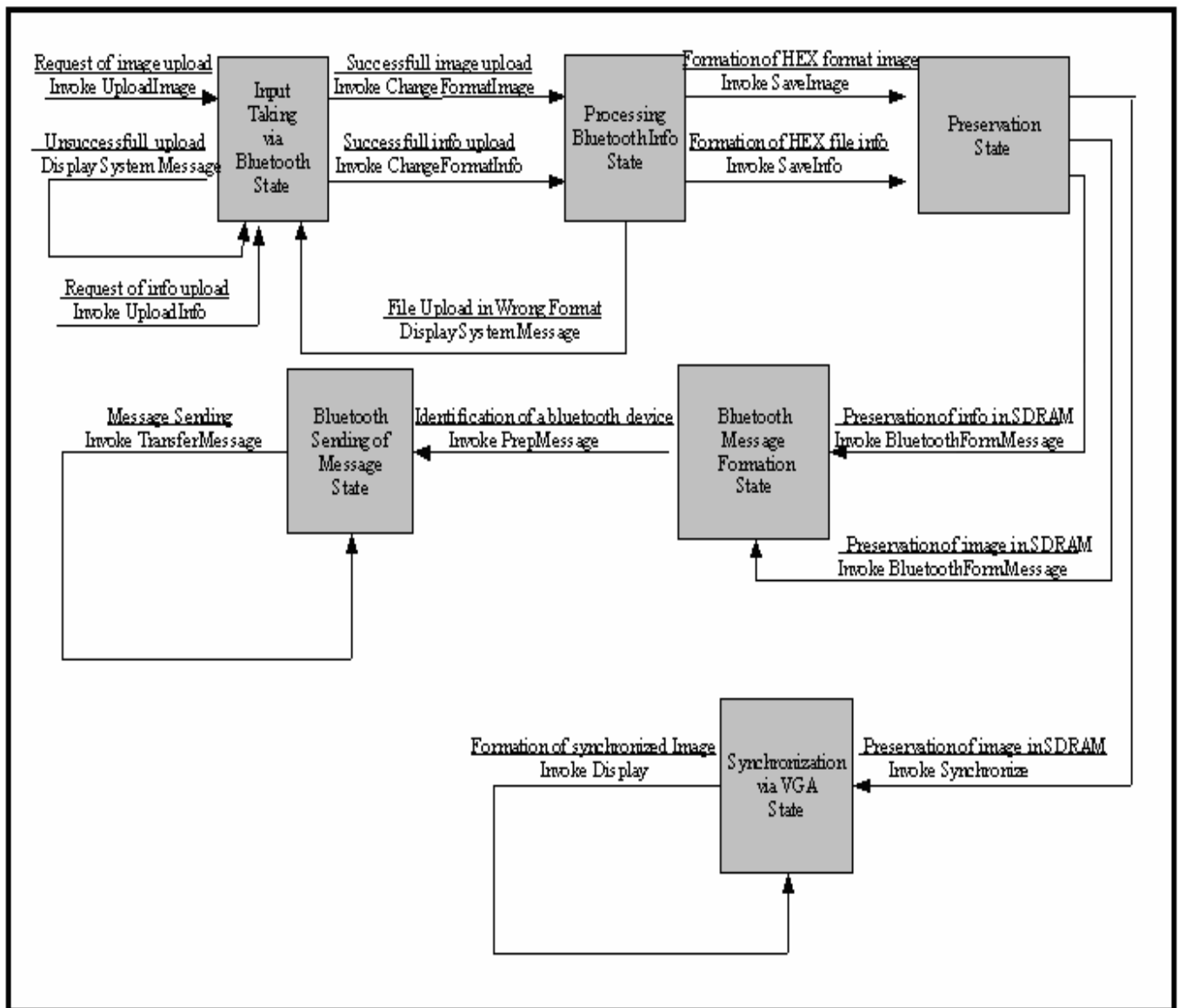
Name	write done signal
Input to	3.1 SDRAM Controller
Output from	3.3 Write Operation
Description	The signal indicating that the current write operation is completed.

5.2 STATE TRANSITION DIAGRAMS

1. For Users who upload information via computer:



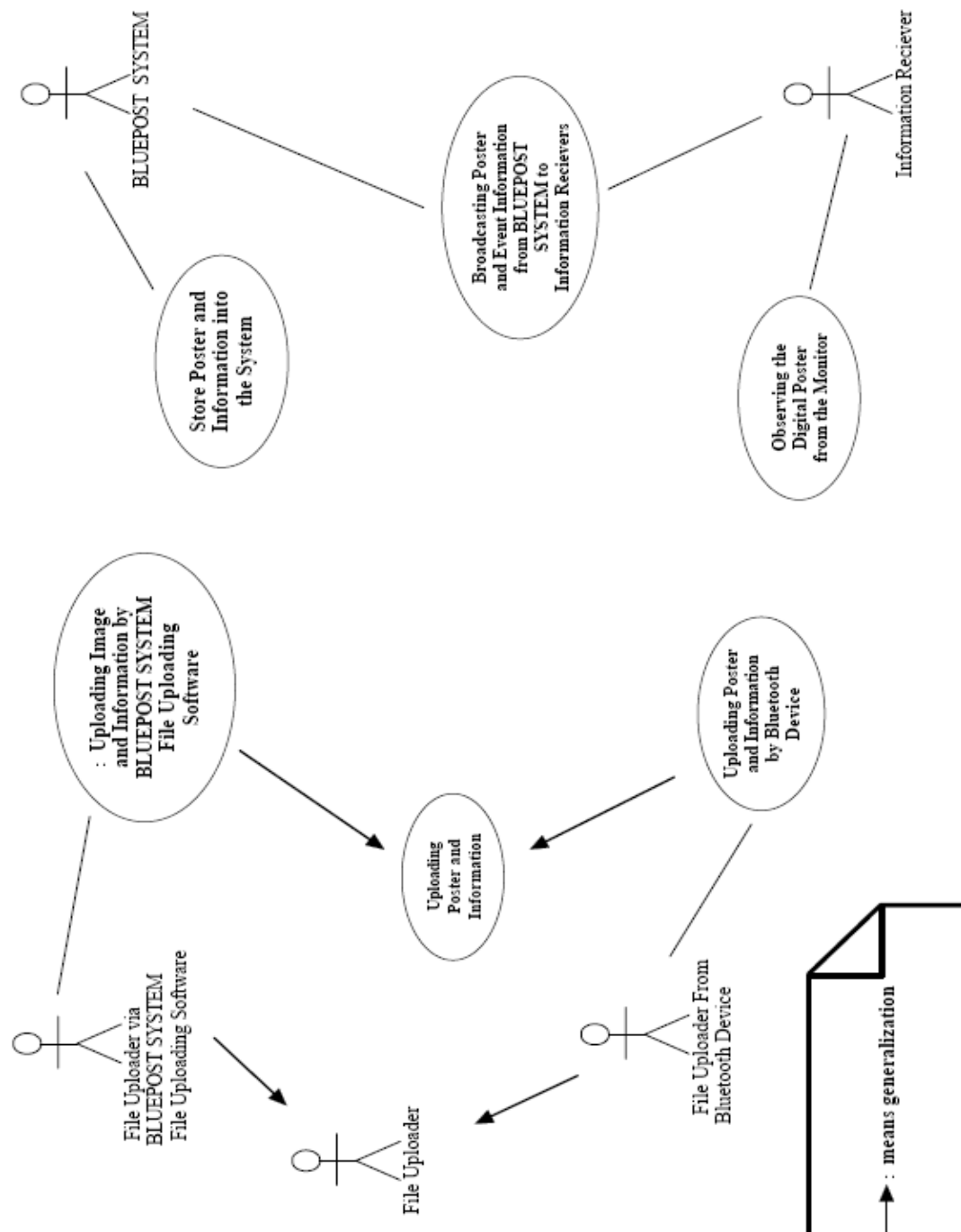
2. For users who upload information via bluetooth:



5.3 USE CASES AND USE CASE DIAGRAM:

5.3.1 USE CASE DIAGRAM

The following figure shows the Use Case Diagram of BLUEPOST.



5.3.2 USE CASES

Use Case 1: Uploading Poster and Information

This use case is for uploading the poster and event information via a computer or a bluetooth device.

Actors: File Uploader

Pre-Condition: The user should have the right to upload files about the event.

Post Conditions: The poster and information is uploaded succesfully to BLUEPOST SYSTEM.

Use Case Relationships: This use case is generalized by 2 other use cases which are Uploading Poster and Information by Bluetooth Device and Uploading Poster and Information by BLUEPOST SYSTEM File Uploading Software.

Use Case 2: Uploading Poster and Information by Bluetooth Device

This use case is for uploading the poster and event information via a bluetooth device.

Actors: File Uploader From Bluetooth Device

Pre-Condition: The user should have the right to upload files about the event.

Post Conditions: The poster and information is uploaded succesfully to BLUEPOST SYSTEM.

Basic Flow:

1. File Uploader From Bluetooth Device uses his/her bluetooth device's file uploading properties to upload poster and event information and uploads them accordingly.

Alternative Flow: If the file formats that the File Uploader intends to send are not compatible or the files do not contain any information or the File Uploader do not have the right to uploading is simply rejected.

Use Case Relationships: This use case is a special key of Uploading Poster and Information Use Case

Use Case 3: Uploading Image and Information by BLUEPOST SYSTEM File Uploading Software

This use case is for uploading the poster and event information via BLUEPOST SYSTEM File Uploading Software.

Actors: File Uploader via BLUEPOST SYSTEM File Uploading Software.

Pre-Condition: The user should have the right to upload files about the event.

Post-Conditions: The poster and information is uploaded successfully to BLUEPOST SYSTEM.

Basic Flow:

1. File Uploader runs the file uploading software of BLUEPOST SYSTEM in order to browse and upload the poster and information files.
2. After browsing the files people uploads the file to be stored in BLUEPOST SYSTEM.

Alternative Flow: If the file formats that the File Uploader intends to send are not compatible or the files do not contain any information or the File Uploader do not have the right to uploading is simply rejected.

Use Case Relationships: This use case is a special key of Uploading Poster and Information Use Case.

Use Case 4: Store Poster and Information into the System

This use case is for storing poster and information into the system.

Actors: BLUEPOST SYSTEM

Pre Condition: Poster and event information have to be already uploaded by the File Uploader correctly.

Post Conditions: The poster and information is stored into the system and the poster is ready to be displayed and the information is ready to be sent to Information Recievers.

Basic Flow:

1. The poster and information that File Uploader wants to upload come to the system to be stored.
2. The system stores the poster and the information.
3. The poster and information is ready to be displayed and sent to the Information Recievers.

Use Case 5: Observing the Digital Poster from the Monitor

Actors: Information Reciever

Pre Condition: The user wonder about the event.

Post Condition: The user gets the information about the event and decides to participate in the event.

Basic Flow:

The user observes the poster and information on the poster.

Use Case 6: Broadcasting Poster and Event Information from BLUEPOST SYSTEM to Information Recievers

Actors: BLUEPOST SYSTEM and Information Reciever

Pre Conditions: A poster and event information should already be stored in the BLUEPOST SYSTEM, and a bluetooth connection should already be established between BLUEPOST SYSTEM and Information Reciever.

Post Conditions: The poster and event information have successfully transferred to Information Recievers.

Basic Flow:

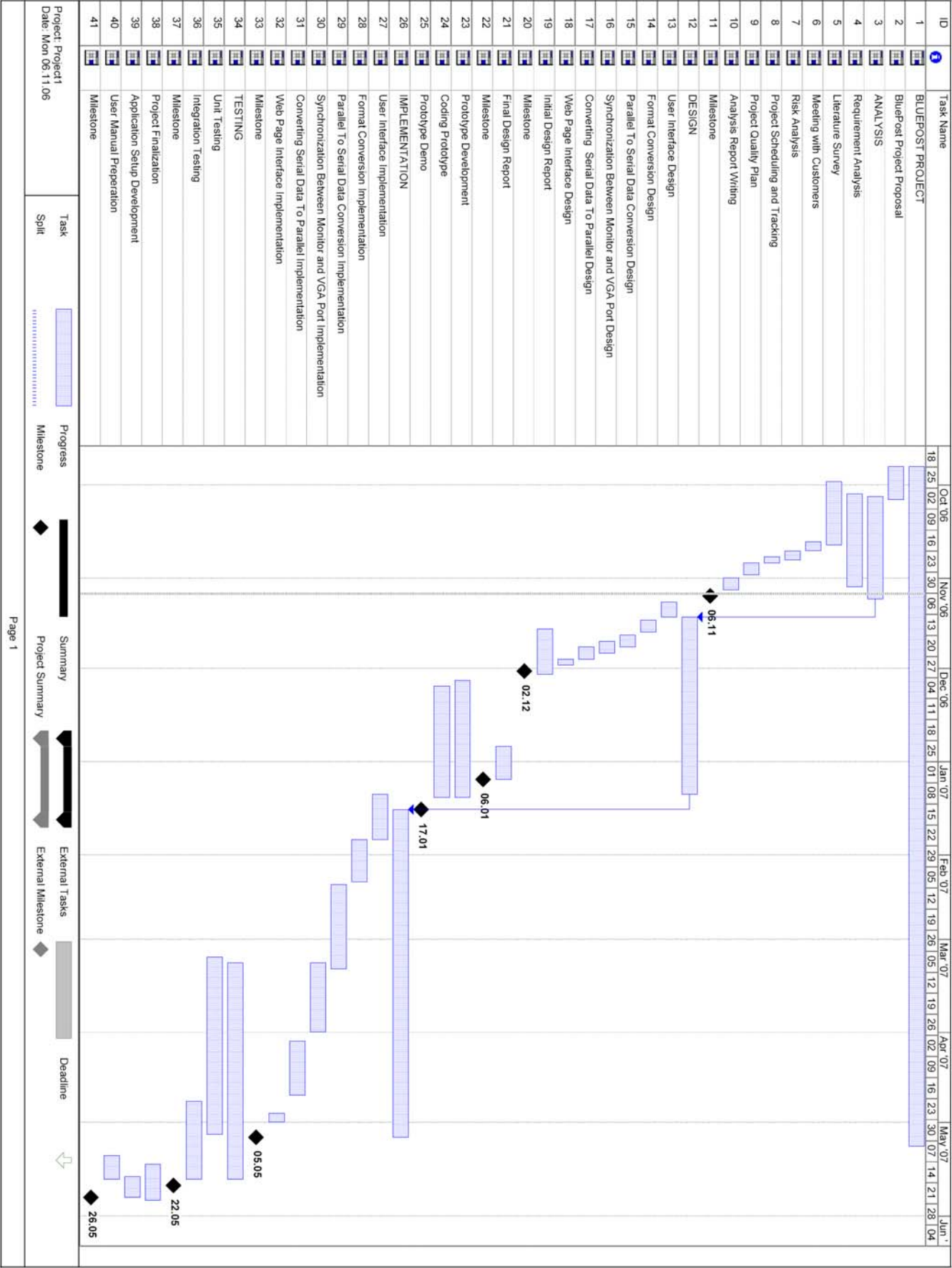
1. Information Reciever establish a connection with BLUEPOST SYSTEM that is already ready to establish a connection.
2. File transfer operation occurs.
3. Connection closes after successful completion of File Transfer.

Alternative Flows:

1. If connection is not established, file transfer request is simply rejected.
2. If connection is lost during file transfer operation, file transfer request is not completed successfully.

A. APPENDIX

A.1 GANNT CHART:



A.2 SAMPLE DESIGNS WITH XSA BOARD:

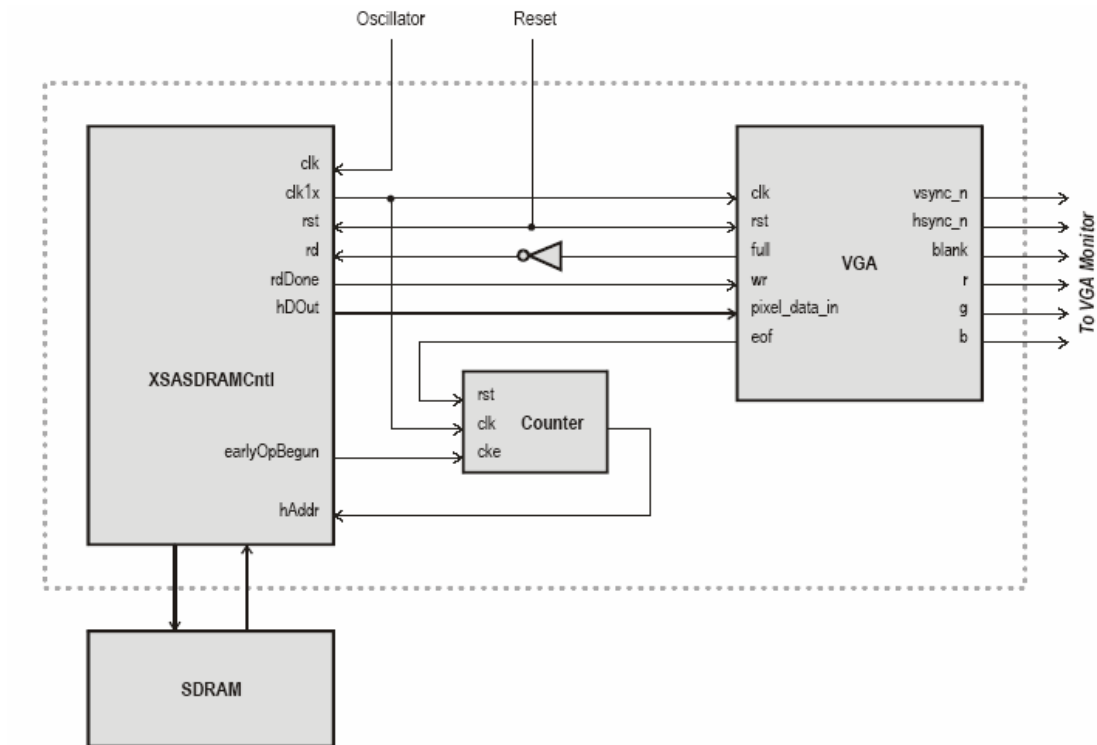
VGA GENERATOR FOR THE XSA BOARDS:

This first example is a simple design which displays an image on a VGA monitor. An image on a monitor screen is composed of h lines, each containing w pixels. There are deflection circuits in the monitors that move electron beams from left-to-right and top-to-bottom across the screen so that a frame is painted. Two sync signals are required for these circuits in order to start and stop the beams at right times. The negative pulses on the horizontal sync indicate the start and end of a line where as the negative pulses on the vertical sync indicate the start and end of a frame which is made up of video lines.

In the VGA Generator Operation, an external system writes pixels values to a pixel buffer where they are extracted to a pixel register. At each clock cycle, the contents of the pixel register are shifted to place the current pixel in the least significant bit positions. These bits are converted to red, green, and blue values through a color-map circuit.

The horizontal and vertical sync signals are generated by two pulse generation circuits. The horizontal sync generator circuit updates its timing counter for each line of pixels. The vertical sync generator is used as end-of-frame indicator. It also clears the contents of the pixel buffer so that the VGA generator starts from a cleared state on every frame.

The following diagram shows the circuit that combines the VGA generator with an SDRAM controller to display the images stored in the SDRAM of the XSA board:



The counter determines the next address in the SDRAM which will be read when the pixel buffer is not full. Once the data in the SDRAM is available, “rdDone” signal indicates that the read operation is complete and the write operation is triggered and data is loaded into the pixel buffer. The “eof” signal becomes high when a complete frame is processed and the counter is reset to the start of the image process.

VGA GENERATOR TEST APPLICATION WITH AN EMBEDDED PARALLEL PORT INTERFACE:

This example is a modification of the application described above. In the previous design, the image needs to be loaded into the SDRAM before the VGA generator is activated. However this design enables you to upload and download images while the VGA generator is active. This feature is achieved by combining the SDRAM controller with the dualport interface.

The dualport module is attached to the host side of the SDRAM controller and divides into two identical host side ports. The two newly created ports work identically as the original host side port so that no modification is necessary in the applications that use the original SDRAM controller. While the application performs read and write operations in one of the ports, other operations are carried in the other port independently.

A parallel port interface is attached to one of the ports and the VGA generator is attached to the other. Images can be transferred through the parallel port of a PC to the SDRAM without disturbing the VGA generator as it accesses the SDRAM.

PONG:

This design example creates a video game similar to “Pong” that shows the use of push buttons and the VGA port of the XSA board. The game displays a border, paddle, and a ball. When the ball hits any object its trajectory is modified. Pressing push button-1 moves the paddle to the left; pressing push button-2 moves the paddle to the right.

The horizontal and the vertical sync signals determine the current row and the color to be painted where as the ball, the paddle, and the border return rgb colors based on the current row and the column.

In addition, the ball sends information about its position to the border and the paddle, which return a “collision detection code”. If a collision occurs, the trajectory of the ball is modified.

A.3 QUESTIONNAIRE:

In order to have some detailed information about what people think about our product to be made, we did a questionnaire with people who have some technical knowledge about our project and also the others who will most probably just make use of our product without caring about how it works.

We asked 10 questions to people and below are the questions with the results (i.e. percentages).

1. Do you know much information about the bluetooth system?

a) Yes

b) No

2. Do your cellular phone or computer have bluetooth system?

a) Only cellular phone

b) Only computer

c) Both

d) None

3. Are you aware of the eases of using bluetooth system?

a) Yes

b) No

4. If yes, how often do you make use of bluetooth in your daily life?
- a) Often
 - b) Sometimes
 - c) Rarely
 - d) Never
5. If yes, for what kind of aims do you use bluetooth?
- a) File transfer
 - b) Headset for cellular phone
 - c) Wireless internet connection
 - d) Listening to music by remote control
6. We are planning to produce a system by means of which you will be able to get information about any kind of events that you are interested in with the help of a bluetooth device and send this information to anyone you want to share. Would you like to use such a system in your daily life?
- a) Yes
 - b) No
7. Where do you think would this system most frequently be used?

- a) For educational events
- b) For social events
- c) For government issues

8. By means of what are you informed about the social and cultural events that you are interested in?

- a) newspapers
- b) internet
- c) friends
- d) posters

9. Would you prefer being informed about the events that you are interested in with the help of a traditional paper posters or digital posters?

- a) Paper
- b) Digital

10. Do you think that making use of our system will make your communication with the people around easier than ever?

- a) Yes

b)No

A.3.1 RESULTS OF THE QUESTIONNAIRE

1) a: %30 b: %70

2) a: %20 b: %30 c: %40 d: %10

3) a: %80 b: %20

4) a: %40 b: %30 c: %20 d: %10

5) a: %80 b: %70 c: %20 d: %30

6) a: %95 b: %5

7) a: %70 b: %60 c: %30

8) a: %10 b: %90 c: %80 d: %5

9) a: %5 b: %95

10) a: %90 b: %10

After observing the results of the questionnaire, we have understood that a lot of people have bluetooth systems in their personal cellular phones and computers and they are getting used to taking the advantages of technology including internet and bluetooth system for many kinds of aims day by day. Besides, a big percentage of the people stated that they prefer digital posters to the traditional ones. As a conclusion, we are assured that the product that we are planning to make will often be used especially for becoming aware of social events.

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