Project Title: BabyMac
Team Name: Microchicks

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Project Abstract:
We will design a game for small children. This is an interactive game that will prompt the user with questions about images that display on a LCD touch screen. The user will have to identify colors, numbers, letters, etc. With the use of the LCD touch screen the child will have three opportunities to get the right answer. If the correct answer is not picked, the game will give away the answer and go to a different image. The microprocessor will control the LCD touch screen output and input, a voice synthesizer chip, and a speaker.
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Project Objectives:

Our main objectives to design this product are:

i. To teach.

- This product serves as an educational tool for young children.
- The early introduction of technology to children will enhance their desire to learn more.

ii. To learn. In order to complete this project successfully we face a great challenge in teaching ourselves to use some tools and devices:

- FPGA
- Simulation tools
- Integration of serial peripherals
- Touch screen programming in VHDL
- Simulation tools

Our technical objectives:

- Design the controller for a touch screen display using FPGAs
- Use LabView to create a GUI which will be used to interface with user and also for data acquisition to keep score.
- Add a voice synthesizer to our design and use C to program it.
- Use the LCD to input responses.

Technical Concepts:
This preliminary report will briefly describe the technology we have chosen as it is shown in Figure 2.

**FIGURE 2. BabyMac’s Infrastructure Block Diagram**

i. Resistive touch screen:

A four wire resistive touch screen consists of two flexible layers coated with a transparent resistive material and separated by an air gap. The two layers are separated by invisible separator dots. When operating, an electrical current moves through the screen. When pressure is applied to the screen the layers are pressed together, causing a change in the electrical current and a touch event to be
registered. We decided to use a four-wire touch screen because they are generally the most affordable and durable so it will appropriate for our application.

**FIGURE 3. Four-wire Resistive Touchscreen composition**

ii. Text-to-speech synthesizer

The BabyMac will feature a text-to-speech (TTS) synthesizer to allow vocal commands and interaction from the game. The TTS chip set of choice is the DoubleTalk RC8650. The RC8650 uses a serial input/output to communicate with the microprocessor and converts received ASCII text to spoken English. This chip has the option of a digital or analog output; the BabyMac will utilize the analog output through an 8-ohm speaker. The RC8650 also has internal memory and recording capabilities, as well as touchtone, musical, and sinusoidal tone generators. The RC8650 was selected because of the quality of the audio output,
as well as the ease of using a serial interface. Figure 4 shows the basic hardware features of the chipset.

**FIGURE 4. Voice Synthesizer Hardware Features**

iii. FPGA

The Cyclone II from Altera was chosen as our FPGA solution. It allows us to implement LVDS (low-voltage differential-signaling) on the display controller. It also possesses on-chip memory that makes the continuous data display less problematic.
iv. Atmel Microcontroller:

   We chose to incorporate the Atmel microcontroller to interface with the voice synthesizer chip and possible to send back serial information to our PC so that we can display the scores with a LabView GUI.

Competitors:

There are similar products to the BabyMac but they are not directed to the same audience. In this project our audience is small children who are just starting to learn shapes, colors, etc. The games that are available in the market for this age group usually do not posses same electronic components that we have included such as the touch screen, the text to speech processor, voice synthesizer, etc. Therefore this product is not comparable to any other kid’s games in the market.

Division of Work:

Katey:

- TTS Development Board Testing
- TTS Breadboard & Code Design
- PC Interface Research
- PC Interface w/ Hardware & Code Design
- PCB Design-TTS & PC Interface
- Development of LabView GUI
Melissa:

- FPGA programming for Touchscreen
- Touchscreen Development Board
- Touchscreen controller programming
- Touchscreen Breadboard & Code Design
- PCB Design
Gantt Chart:

Available Weeks in Spring 2009

- (M+K) Preliminary Project Proposal
- (M+K) Research/Project Proposal
- (K) TTS Development Board Testing
- (K) TTS Breadboard & Code Design
- (K) PC Interface Research
- (M) TScreen w/ Development Board
- (K) PC Interface w/ Hardware & Code Design
- (M) TScreen w/ Breadboard & Code Design
- (K) Katie @ Interview (Off)
- (M+K) Integration of All Parts
- (M) PCB Design-TScreen-M
- (K) PCB Design-TTS & PC Interface
- (M+K) Populate PCB
- (M+K) Testing & Troubleshooting
- (M+K) Spring Break
- (M+K) Final Presentation (April 14)
- (M+K) Final Demo (April 16)

- Planned
- Extension
- Down time