IMAGO solutions corp.

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ensc440-proj@sfu.ca

June 12, 2006

Dr. Andrew Rawicz
School of Engineering Science
Simon Fraser University
Burnaby, British Columbia
V5A 1S6

RE: ENSC 440 Digital Photo Album Post Mortem

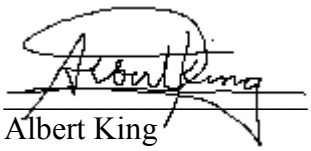
Dear Dr. Rawicz:

The attached document is a post mortem report for a *Digital Photo Album* that generally describes the outcome of this project. We have developed a digital photo album equipped with a user friendly interface with large storage capacity and a big screen for comfortable viewing. Our product will bring people a new way to enjoy their photos without worrying too much about cost and storage.

This document outlines the current state of our device and the future that we intend for our product. It also talks about our time budget deviations from the original plan and as well as our individual experiences during our product development.

Imago Solutions Corp is composed of four engineering science students: Timothy Chueh and Ali Rawshanaei doing Computer Engineering Option, Albert King doing Systems Option, and Patty Sa doing Electronics Engineering Option. If you have any questions, comments or suggestions, please contact us via email at ensc440-proj@sfu.ca or call me at (604) 805-9754.

Sincerely,



Albert King
Imago Solutions Corp.

Enclosure: Digital Photo Album Post Mortem

IMAGO
solutions corp.

Digital Photo Album

Post Mortem

Project Team: Albert King
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Submitted to: Andrew Rawicz
Steve Whitmore

Issued Date: June 12, 2006

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Introduction

For the past five months, Imago Solutions has been working on a prototype for an electronic photo album. Imago Solutions, comprised of Timothy Chueh, Albert King, Ali Rowshanaei, and Patty Sa, has developed an innovative solution to meet the evolving needs of the photographic market. We have developed a digital photo album that serves the market demand for better portable viewing and storage. This document details the current state and the future of our device. It also talks about our deviations from the original plan and the work that was poured in to accomplish our goals.

Prototype State

In setting out to build our prototype, our goal was to accomplish all our Priority I and II functional requirements. In our planning, we determined that achieving such a device in our given time frame would be both challenging and realistic. The current state of our prototype reflects the achievement of our goal. Small differences between our functional specifications and our current prototype will be discussed in the next section. Discussion of the current state of our prototype will be looked at from hardware and software perspectives.

Prototype Hardware

To keep our development cost low, we are using industry standard development tools that are readily available. Currently, our prototype is composed of the following components: an ARM922T 32 bit RISC 200 MHz microprocessor on a Sharp LH7A404 card engine, a 6” Logic LCD screen, a Logic sharp development board, Microsoft keyboard, and a multicard reader/writer.

The current state of our prototype is an open type software development kit. The LCD screen is directly connected to the development board. Our card engine supports the LCD display; it has an onboard LCD controller supporting up to 1024 x 768 x 8 bits per pixel. Our LCD screen allows us to display descent image quality to properly demonstrate the main functionality of our device. For our actual device, we would need a screen with a much higher pixel density and more color in order to have a more vibrant display. The keyboard and the multicard reader writer are both connected to the onboard USB controller of our development kit. Our current hardware setup was made only to demonstrate the basic features that we have proposed to have on our product. We have not included a battery in our prototype; our device currently runs on an adapter that is connected to an AC wall socket.

Prototype Software

The main software development for our device focused on the firmware that would run on our hardware setup. Currently, our firmware is feature complete and has received significant testing to ensure bug free operation. In its current state, we feel confident in giving demos on the novel abilities of our software running on the hardware.

Although the software is feature complete, there are still two key changes that will be made before we will consider the firmware commercially ready. The firmware currently runs in a single threaded manner which allows for only one operation to occur on the hardware at a time. Our code will change to run in a multi-threaded manner in the future. The key benefit to running multi-threaded code is the ability to maintain a responsive user interface while the device performs other processor intensive tasks such as image manipulations.

Our current implementation of JPEG encoding and decoding may also change. For decoding, our prototype currently uses Microsoft's .NET Compact Framework 2.0 for the image, and our own implementation for decoding EXIF information imbedded in the JPEG files. For encoding, our prototype currently uses a publicly available JPEG encoding library for the ARM Processor along with a custom wrapper to allow the use of that library with our code. The reliance on software encoding and decoding of JPEG images makes operations on large images (i.e. 8+ megapixels) slow. Before we will consider our firmware commercially feasible, we will look to improve our JPEG handling performance. Current options that we are considering include a more efficiently operating JPEG library that we can license, a faster processor, and hardware accelerated JPEG encoding that we can access via our firmware.

Deviations from Original Plan

- **Budgetary Changes**
  We did not deviate much from our original budgetary plan. In fact, we spent a lot less than what we expected to spend for our prototype development. We saved some money by not purchasing a harddrive for our device; we only needed to demonstrate storage capability which we have accomplished by purchasing a much cheaper compact flash card. Table 1 shows our spending compared to our budget. Our original budget estimate was made US dollars but our actual spending was tallied using Canadian dollars. Based on the conversion rate at the time of purchase which was around 0.862 Canadian to one US dollar, we went well under our proposed budget.

Table 1: Budget Deviation

Equipment	Actual Spending	Prototype Budget
LCD kit	$1068.52 (6.4" screen)	$900.00 (6.4" screen)
Development Kit (microcontroller)	$472.10	$400.00
Hard Drive	$34.00 (256MB CF card)	$300.00 (8GB)
Battery	$0.00	$10.00
User Interface	$15.00 (keyboard and multicard reader)	$50.00
Case	$0.00	$20.00
Wires	$0.00	$20.00
Taxes and Shipping	$116.40	
Total Cost	**$1706.02 CAD**	**$1700.00 US**

- **Schedule Deviations**

We deviated heavily from our proposed schedule. With an extension on our project, the time frame proposed in our Gantt chart was stretched. Although we did not follow the dates in our Gantt chart, we used the framework of that timeline to determine the order we would tackle our tasks.

Our functional hardware platform was completed around mid march. Once we had our working hardware, we put the project on a temporary hold while our group members focused on our finals. During this period, we continued to experiment with our hardware by trying out small test applications. Immediately after our finals, we began work on writing our firmware.

Completion of our proof of concept prototype concluded around the third week of May.

Prospects for the Device

Currently, we are happy with the progress of our device and are excited at the prospects. Some of the members of Imago Solutions intend to continue with the development of this product with the intentions of bringing it to retail. Between where our current development stands, there is still a lot to accomplish to reach our goal. As we continue to develop our firmware, the next major task involves developing our hardware into a form factor that will be ready to be put in a commercial product.

In taking the steps required to bring our product to retail, we will be looking towards outside help in the form of a mentor and possible angel investor. Our goal will be to have this product released in a limited fashion in time for vacationers in the summer of 2007.

This initial launch would be followed by a wider release in time for the Christmas 2007 shopping season.

In speaking with a wide variety of people, enthusiasm for a product such as ours is high. We have spoken with computer users, non-computer users, point and shoot photographers, amateur photographers and semi-professional photographers. Amongst all the people we have spoken with, they have either expressed great interest in the storage and display aspects of our device, or our target price point.

We feel confident about our products ability to compete against its competition. Through our personal experience and the testimonial of others, we believe our product is more intuitive, offers more features with respect to photographs, will offer better performance and cost less than its closest rivals. Competing products that we have had personal experience working with include the iPod (both photo and video variants), Creative Zen Vision and the Epson P-2000.

Our Experience

Albert King

For the past few months, we have toiled tirelessly on our project. During this span of time, I have learned many important lessons that would greatly enrich me in both technical and personal areas. I have also learned to value the camaraderie within in the engineering community (inside and outside of SFU) as they have helped us a lot in the course of our project development.

In technical aspects, I have learned many things about the modern embedded hardware used in commercial products. I handled the purchase of our development kit which required extensive research on SOCs (system on chip) specifications and their availability in development packages. I also had to find a supported LCD screen by the SOC and also make sure that the LCD can demonstrate the functions of our device. I was also intensively involved in the software development for our product. I developed most of the functions used by the GUI in handling files, file buffering, photo thumbnailing and others. One part that I am particularly proud is the EXIF (Exchangeable Image File) format reader that I wrote for this project. We could not find an available free EXIF reader for the CF (compact framework), but we were determined to have this feature on our demo product, so I had to write it from scratch. This experience was bitter sweet. It took a lot of hard work and time to write this program but the fruit of the labor was very sweet.

The most essential lessons I have learned in our development experience would be the lessons of *Patience* and *Endurance*. Many times while working on our project, I had urges of quitting especially when I can not find some things that I need. Trying to be patient when you have ran out of patience is hard; so is enduring when you are tired and lost and don't know what to do. But just as the saying goes, "No Pain, No Glory". I had to try harder than I have ever tried; I have to endure the pain and look forward to the glory. In the end, the old cliché was right.

One important thing that I have usually neglected is to appreciate the hard work put in by the public online community. I can say that about 95% of the information that we used for our project were taken from the internet. These people put their heart and soul to gain these information only to put them online, to be freely available to the public is something of heroes. To them, I give my thanks.

Through four years of university, I have worked on many projects with levels of difficulty of ranging from high to very high, but the ENSC 440 project exceeds these levels by far. This project felt a lot like when you were about finish swimming lessons and you were asked to swim alone for the first time without the kickboard or any kind of floatation device. Initially, you don't know what to do or where to begin lots of worries going through your head. Then you give it a kick and all of sudden the situation goes from worse to worst because now you have this weird sensation that you are sinking, and the more you kick wildly the more you sink. You start to feel panic and fear overcomes your whole body. But then you started to think about the lessons you have learned in the past; you start to understand what is happening and things start to simplify. The more you gain confidence the more you start to float and little would you know you are already swimming. The 440 project is very similar experience, and just like swimming, when you have recognized that you can swim, there is a great sense of satisfaction and pride that comes along at the end that makes the pain and suffering all worth while.

Timothy Chueh
The first thing that comes to mind when I think about what I've gained working on my 440 project has been the realization of what I can accomplish in a short period of time. Working in a group setting proved challenging at times, but it also gave me new insight to what works, and what doesn't work within a group. I learned the importance of assigning work to individuals that help accentuate their strengths. With the course related portion of this project soon behind me, I get to move on with the satisfaction of completing one of the largest projects I've ever worked on, as well as the excitement of what's to come.

This project offered me the opportunity to program in a new language that I had no previous experience in, C#. I was hoping to use this project as an "excuse" to force exposure of some sort of technology that I was unfamiliar with. Becoming proficient at a new programming language fulfilled that desire. This project also gave me the opportunity to write software as firmware for a hardware platform I had no previous experience with. As an aspiring engineer with interest in design, this experience showed me how creative uses of existing technology can make new and exciting products. All you need is a good idea.

As a person who often prefers to take care of things on his own, working on this project has exposed the need to trust others in their work. In order to accomplish a large task, the work must be divided. Ultimately, someone will do something that you would have done differently. It was a mental hurdle for me to get over the desire to do things "my way".

Reflecting on the past five months, the most important experience that I'm grateful for is the importance of people. With interest in starting my own business after graduation, this project has made it loud and clear to me how important it is to carefully choose who I work with, to tactfully assign work to people that maximizes their potential, and to be discerning with who I look to for help and advice. Since starting a new business is no easy task, I believe that in some scenarios, "people decisions" can make or break the business.

Ali Rowshanaei

I worked mostly on the design and implementation of the database for the album. Since the version of the Windows CE we ended up using for developing this prototype was a demo, we were not able to install any additional software on it. This means we could not install a database engine on the Windows. As a result, we used text file for the database. In designing the database using text files, I tried to design it a way so that it will be easily converted to a table-based database. I considered some of database methodologies such as normalizing. The database for the album contains a main text file for all the photos in the device. But each photo exists only once in that text file. For each sub-album a new text file is generated which contains only index numbers of the photos. This is because we only need the index number to link back to the main file. I implemented a static class in imbedded C# for this database so that it provides functions, which are used by the interface and the file-transfer modules.

Patty Sa

Participating in this project has been a very interesting experience and allowed me to see how a team of very different individuals works together. My group members were great and right at the beginning of the project we discussed our individual strength and weaknesses and went from there. Although I could not contribute as much in certain technical areas I tried to make it up in other areas like the documenting when planning the project and anything related to graphical designs. I also helped do some surveys on artists who often need professional pictures as references to draw from. I did find however that my fellow group members exceeded me in some technical knowledge areas which prompted me to learn more to keep up with them in the future. In conclusion, I had fun working with the group and found the importance of a team when working on something as large as this.