

Using Smartphones to Preserve Genealogical Information

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1. RESEARCH OBJECTIVE

This paper reports on an experiment to evaluate whether smartphones can be used to preserve genealogical information.

2. BACKGROUND

There are over a billion smartphones in the world and the number is still rapidly growing¹. If smartphones can be used in document image capture, the cost of equipment for genealogical data capture can be eliminated or greatly reduced.

During the past few years technology has made startling progress in the areas of camera sensors, image processing, CPU speed, LED lighting, storage capacity, and software sophistication. Many of these new technological innovations relate directly to the photographic and scanning functions. And many of them show up first in smartphones because of the huge importance of that marketplace.

Once a genealogical record is digitized it can easily be stored, replicated, transmitted, and shared. Digitized records can also be more easily organized and processed and once character recognition (OCR) or indexing is done they can be searched and processed in many additional ways.

3. THE BASIC CHALLENGES

This paper analyzes the basic problems in using smartphones for document capture. A typical smartphone camera now creates eight-megapixel images, with some going as high as 40 megapixels. This is adequate **resolution** for

indexing, OCR, and general use of the images as genealogical documents. Also, smartphones are very portable which offers a big advantage for genealogical document capture.

However, the hand-held nature of a smart phone makes it difficult to consistently and reliably align the edges of the image with the edges of the document. Some type of **stable and easily repeatable alignment** is needed in a document capture system. Stable alignment is typically achieved for “stand-alone” cameras with tripods but smartphones are not designed for use with tripods and some **special attachment device** must be used to connect a smartphone to a tripod. And can the camera be activated without disturbing the alignment? Also, tripods are generally designed for horizontal sighting. Special stands are available for **vertical sighting** but they are awkward and bulky. Can anything short of a music stand or wall mount be used to allow for stable alignment?

Documents generally have smooth white surfaces that reflect much of the light generated by a camera flash, especially when the flash is close to the document. This causes a **washout** or **burnout** effect in the center of the image that greatly detracts from the readability and usability of the image. Center washout can be avoided by turning off the flash, but this makes it much more difficult to obtain **adequate lighting** for the image, especially when working in a library or record depository or on a research trip. Control of the lighting is essential for a good document capture system. Simply being able to turn on or off the flash is not acceptable in many situations.

Smartphones include special **focusing features** such as smile detection, auto-focus, tap-to-focus, and other features that may work

counter to the capture of a suitable document image.

And in addition to a consideration of these challenges, it is important to maintain the **portability** of the smartphone and to not add significant complexity to the use of the smart phone for document capture. In addition techniques for **organizing** the documents are needed as they are captured and not after the fact.

4. THE EXPERIMENT

We will use the RootsTech “Call for Papers” document for FHT part of Conference (see Image 1 below) to illustrate some of the challenges in using smartphones for document capture. We will run a series of tests on this paper and try to determine guidelines for how to do genealogical document capture.

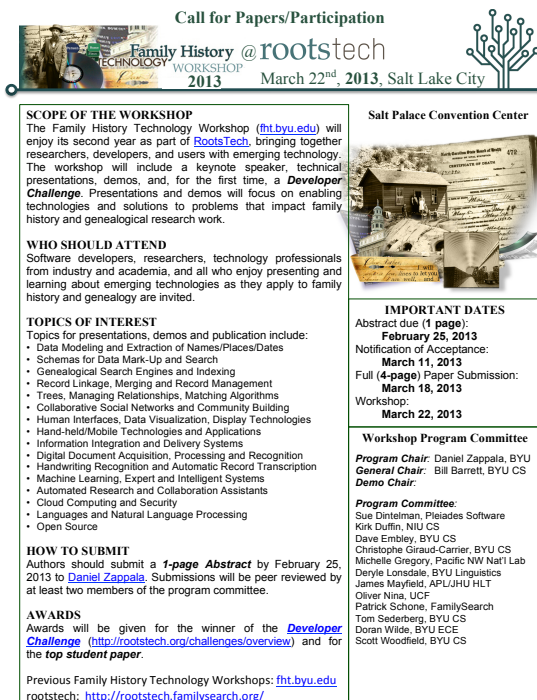


Image 1: Original document.

5. POINT AND CLICK

Image 2 is our attempt at digitizing the

document with “point-and-click” approach. Things that must be simultaneously considered in the point-and-click approach are the alignment of each of the four sides of the document, the tilt of the camera, zoom-in and zoom-out, and the quality of the picture. This is a lot to do simultaneously. Image 2 below is our “best” effort at point-and-click.

We were able to align the two sides fairly well, but failed to align the top and bottom very well. Also we didn’t notice that the camera was slightly tilted. Finally the camera was on auto-flash and produced a burned-out spot in the center of the document.

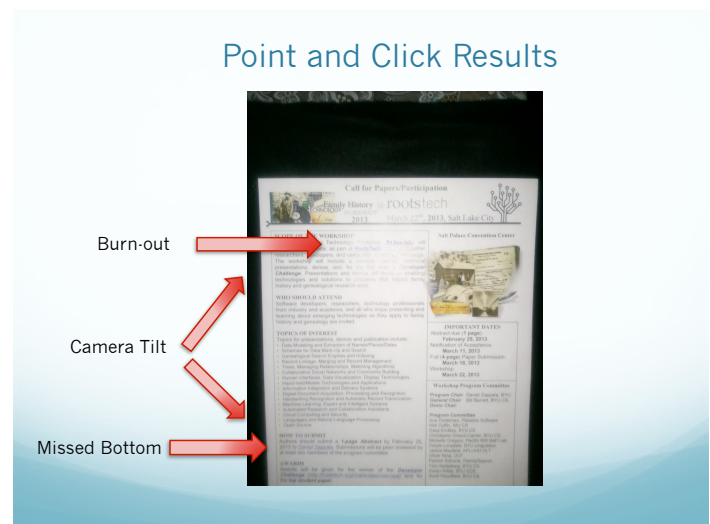


Image 2: Point-and-Click Results

6. STABILITY & ALIGNMENT

Our conclusion from this part of the experiment was that digitizing documents is greatly simplified with some kind of support to stabilize the smartphone. Over the past 2-3 years there have been many “scanning” devices proposed to support smartphones. Tripods, boxes, tables with holes, booms, clamps, suction cups, magnets, etc. are being offered or proposed^{2 3 4 5 6}.

7. LIGHTING

Adequate and uniform lighting is a critical

aspect of scanning. It has been either ignored or poorly addressed in the smartphone scanners proposed to date. Our hope is that at some point smartphone light processing and flashes will be able to avoid the “burnout” that now seems inevitable in the center of scanned documents. Perhaps it is already there but we have not found it yet.

Support Stand with no Flash

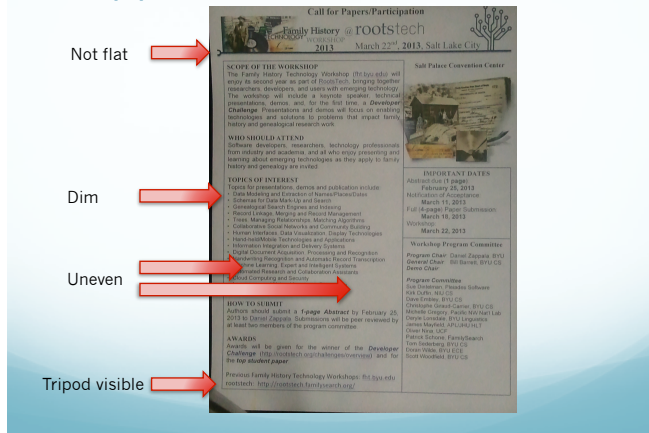


Image 3: Tripod and No Flash

Until that problem is solved, we must resort to turning off the flash and adding additional lighting. We initially hoped that we could achieve something adequate with a single light source. However, for uniformity that light would need to be directly over the document, and that would put us in danger of having the light reflect directly back into the lens again and cause burnout as the flash did and/or perhaps create a shadow of the smartphone and support mechanism on the document.

The photographic industry has resorted to at least two light sources to achieve uniformity. Image 4 was taken with two light sources. It demonstrates that even with two light sources the result is not perfect.

8. FOCUS AND ADJUSTMENTS

We have not found the special focus and other options useful on the Galaxy S smartphone that we have tested, but we are continuing to test them. In fact, some of them seem to work

counter to what document capture needs.

Added Light

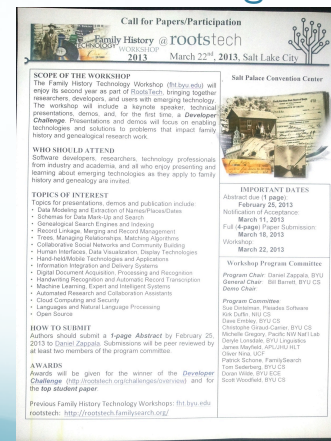


Image 4: Two added light sources

9. DOCUMENT FLOW & AUTO-CLICK

A critical part of the scanning process is the placement of each document in a position where it can be scanned. As noted earlier this process is simplified if the smartphone is supported in a fixed position and our attention can be focused on the presentation of the document to the scanner (the smartphone).

Commercial scanning devices often come with “sheet feeders” which feed the documents one sheet at a time to the scan position. Although they add cost to the scanner, they can speed up the scanning process for documents that are uniform in size and in good enough shape. However, genealogical documents are often aged, vary in size, or may be too precious to trust to a sheet feeder. In one project we scanned 70,000 genealogical and local history images. We found that much of our time was spent unjamming the sheet feeders and in shifting from one type of scanner to another⁷.

One of the authors of this paper has invented a very rapid document flow algorithm for smartphones that in many situations may be faster than sheet feeders. Many smartphone cameras can sense motion. Peter has programmed a Samsung Galaxy S III to take a

picture each time motion ceases. Thus, one can lay a page in front of the smartphone, remove his/her hand, and have the smartphone take the picture, lay the next document in front of the smartphone and have it take a picture when motion ceases, and so on.

This has the additional advantage that one does not have to change one's focus from the documents to the camera, find the "button" to push, and then push it and perhaps jostle the smartphone out of position in the process.

Peter has included one interesting additional capability to this Auto-Click function. Whatever is said between Auto-Clicks is captured and associated with the document as audio to help identify and describe it. At one point we scanned 40,000 genealogical documents relating to our own family history. It is now difficult to go back and identify what was scanned. The more information that can be added during the scan, the more chance there is of being able to find and use the scanned images later. The metadata that is automatically added to some types of images (tif, pdf) helps but is far from enough.

10. IMAGE FLOW

We call the flow of documents as "document flow" and the flow of digital images created from the document as "image flow". We have tried email, DropBox, and some Google options for moving the images to a computer or to the cloud for further processing. We have also used a USB cable. We do not have a single recommendation on what to use yet. There is much more that goes into a useful document capture system than just the creation of images of the documents. The scanning of genealogical documents is only a part of the process of capturing and digitizing documents.

11. LESSONS LEARNED

Our initial conclusion is that settling for a "point and click" approach will not generally

produce useful results, but one can get useful results if the smartphone is mounted on some type of support and if adequate attention is paid to the lighting. The support can be done in a variety of ways that are adequate. We have used a 42 inch collapsible tripod that collapses down to about 12 inches with some satisfaction.

We view this effort as a "work-in-progress" and invite others to join us in this test. We invite you to sign up to be part of an on-going research effort to better define what is needed.

We are excited about the potential of our auto-click method. It is an example of how the power of smartphones using the latest technology offers options and benefits that may not be possible in commercial scanners for some time to come.

REFERENCES

¹ [Worldwide smartphone user base hits](#)

[1 billion | Mobile - CNET News](#)

² <http://www.kickstarter.com/projects/scandy/scandy-scans-with-your-smartphone>

³ http://www.cbsnews.com/8301-505143_162-28644458/turn-your-smartphone-into-a-document-scanner/

⁴ <http://www.makeuseof.com/tag/build-smartphone-document-scanner/>

⁵ <http://www.instructables.com/id/Smartphone-Document-Scanner/>

⁶ http://news.cnet.com/8301-17938_105-57451695-1/this-little-box-turns-your-smartphone-into-a-scanner/

⁷ This involved the scanning of about 10 filing cabinets and 50 boxes of Nauvoo Restoration Incorporated documents created from 1950 to 2005.