



Accelerate EMR Application Development Using Imaging Tools

We are on the cusp of the greatest opportunity in U.S. history for improved healthcare through expanded availability of patient data. As the EMR revolution gains steam, with the help of nearly \$20 billion in new funding through the American Recovery and Reinvestment Act (ARRA), more custom implementations will be built and deployed to serve the specific needs of hospitals, clinics, physician's offices, and other providers. Images are a vital, yet highly challenging, part of nearly all EMR designs. Using third-party tools for handling images enables you to add advanced features while speeding up development, reducing cost, and getting your product to market sooner.

One Less EMR Worry

Let's face it...there's nothing simple about "solving" the EMR problem. Some of the many difficult issues that confront designers of comprehensive medical records systems include: connecting incompatible systems, user security, maintaining data integrity, and optimizing the interface for each user.

The ability to properly handle images in your application is one area where there's help. The faithful display of images, even when diagnostic quality isn't required, is a very complex requirement. There are many sizes, resolutions, bit depths, and file formats that may need to be supported. Software to compress, manipulate, and display medical images must be compatible, reliable, fast, and well-supported.

Detailed knowledge of the intricacies of image compression, manipulation, and display probably isn't included in your core competency. Many of the world's largest makers of imaging systems rely on Accusoft to provide them with imaging expertise. It's the most cost-effective way for them to handle their imaging needs. For every smaller enterprise, the case is even stronger.

Advantages of Accusoft Imaging Software

Compliance with Standards

Radiological imaging relies on a variety of lossy and lossless image compression standards, while document imaging has its own set of image formats. These standards are varied and complex and many continue to evolve. New standards are always under development, so maintaining and verifying compliance is a never-ending task. Accusoft works with standards committees and compliance organizations to offer timely format support within our products.

Experience and Reliability

Because imaging standards can be highly complex, not every developer always interprets them the same way. Sometimes, your system will need to do the best it can with images that are *not* compliant with the standards. There are numerous examples of large sets of images that were stored with slight incompatibilities. Experienced imaging vendors with many different customers tend to discover these rogue images more quickly, and know how to support them most



effectively. Accusoft has been a trusted leader in the imaging market for over 20 years. This long track record allows software developers to rely on their imaging technologies in the future.

Speed

Images created during radiology can be much larger than typical photographs. Compressing, decompressing, or manipulating these large images imposes very high demands on CPUs, particularly when processing large numbers of images on servers. Accusoft delivers tools that are optimized to deliver the fastest performance in the industry.

Future Needs

Although your current vision may not include TIFF documents, or Lossless JPEG files, or Windows 7 or Silverlight support, a new customer may introduce a sudden change in requirements that was previously unforeseen. Since our tools are built for thousands of implementers, we support an incredible array of imaging technologies. Adding another one can be as easy as adding a few lines of code to your existing application. If another SDK is required later, there are many advantages of using one from the same vendor.

Breadth of Function

You may not even foresee them when you create your original system specifications. But when hundreds of functions, from Anti-Alias to ZoomRectangle, are available to you at no added cost, you may discover ways to enhance your end-user's viewing experience. The availability of advanced functions may also present new opportunities for processing, annotating, or sharing image files.

A Few Use Cases

Ok, we've answered the "Why?" of using SDKs for handling images in EMR applications. So, let's get on to the "What?" Some of the following examples may represent capabilities you are already planning to incorporate, while others may suggest new features you might wish to add that will improve usability, expand distribution methods, or increase functionality. These use cases also serve to illustrate some of the many problems that can be simplified by adding one or more of our imaging SDKs to your application.

Radiology and DICOM Files

One of the first things you'll encounter when you incorporate any kind of radiological imaging in your application is the standard for Digital Imaging and Communications in Medicine, or DICOM. The use of DICOM is very widespread in radiology, and its features go far beyond image file types and metadata, including basic file structures and communications protocols. What a Windows-based computer treats as a single **.dcm** file is actually a highly complex structure containing any number of patient studies, each involving one or more series of images, plus details about how each image was captured, along with numerous patient, physician, and facility data entries.

If you only need to display and edit data and images from DICOM **.dcm** files, [ImageGear Medical](#) includes everything you need, on a wide variety of platforms. The screen below illustrates a very simple view of some of the data behind a CT image. Your application could



display any of the available data in the format that is most useful for your end-user. The source code provided with sample programs that are downloaded with the toolkits illustrates how you can access this data when building your own custom application.

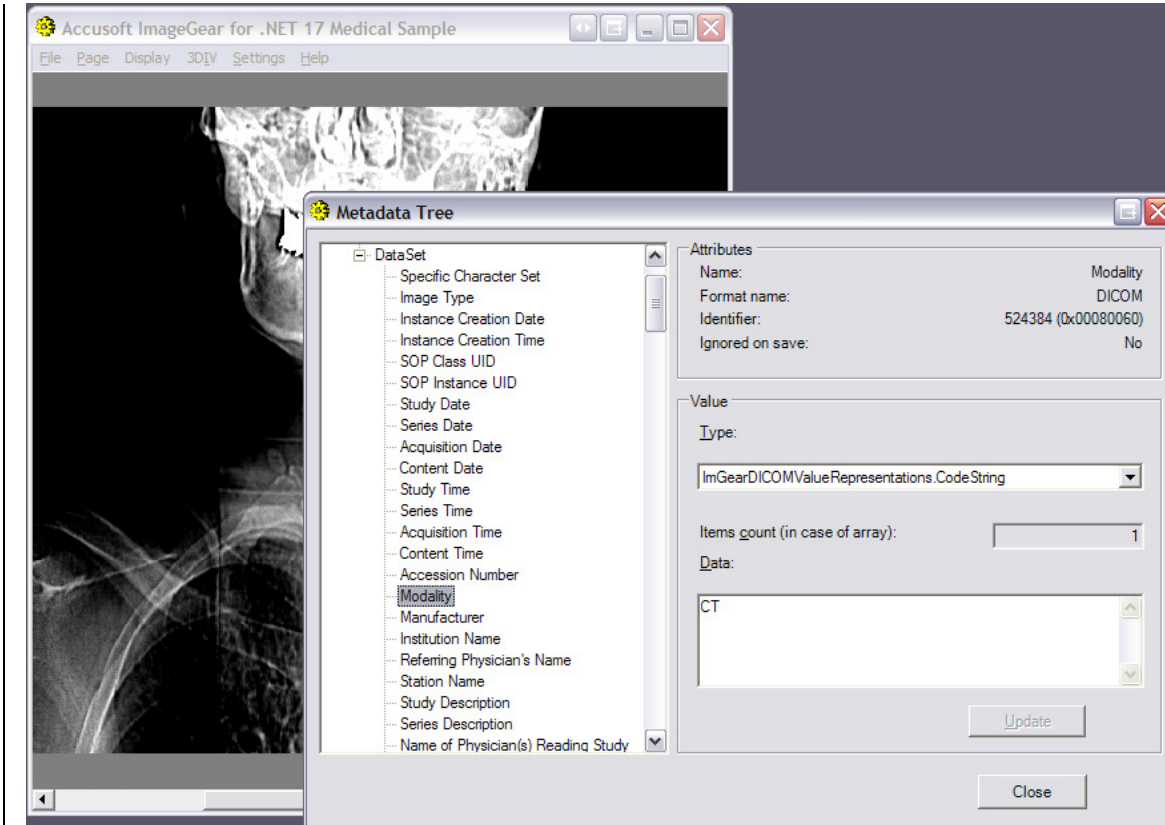


Figure 1: A view of DICOM data from an ImageGear Medical sample program

If you need to communicate with an existing PACS system, or directly with a DICOM-compliant device, you'll need our [ImageTransport MD](#) toolkit. It implements the protocols that allow you to communicate with a Service Class Provider (SCP) or Service Class User (SCU), and also includes the capability to read and display the contents of a DICOMDIR structure.

Lossless Image Compression

Whether you extract them from DICOM files, or you obtain radiology images in some other way, you'll also quickly discover that there are some uncommon types of files you will need to display. When diagnosing disease states, the industry is reluctant to accept any changes as the image data is compressed or decompressed. The JPEG 2000, JPEG-LS, Lossless JPEG, and JPEG XR file formats all provide lossless compression options. Typical lossless compression ratios are only two- or three-to-one, which is far less than the ratios of 10 or even 50-to-one that lossy compression can yield. But the lossless formats guarantee that absolutely no information is lost when the file is compressed and later decompressed for actual viewing. Accusoft has

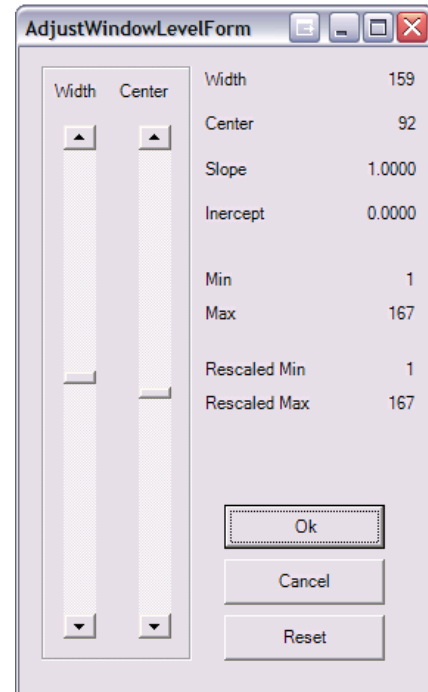


long been the leader in medical image compression, and supplies this technology to most of the leading equipment makers, as well as many independent software developers.

High-gray Images

Accurate diagnosis using medical images can benefit from the ability to resolve very fine differences in the densities of the areas under observation. A typical 24-bit color JPEG image, for example, can actually only represent 256 different levels of gray. To store more variations in wave penetration, radiology equipment often uses from 10 to 16 bits of information for each pixel. This increases the number of possible gray levels that can be recorded from only 256 up to as many as 4096. Unless your imaging tools are designed to handle these “high-gray” images, however, you won’t be able to properly decode or display these files.

Moreover, most typical monitors are not capable of accurately displaying more than 256 shades of gray. To be able to see all of the available information in these images, adjustable controls for the width and center of the range of viewing data are needed. Default window Width and Center values are frequently stored along with DICOM images, and may need to be adjusted as images are studied. Also, specific look-up tables (LUTs) can be used to map non-linear curves to more accurately match display characteristics to wave penetration variations. These controls and features are built into a variety of viewing tools designed for medical images.



Advanced SDKs such as ImageGear and ImagXpress allow you to build custom viewers on Windows-based platforms using ActiveX controls, .NET assemblies, or Silverlight. You can also build solutions for various UNIX/Linux platforms using ImageGear or PICTools.

Other Special Images

Along with the special image formats mentioned above, medical images can have other characteristics that rarely occur in photographs or documents. For example, EKG and maternity labor monitoring devices can create images that are only a few hundred pixels high, but many thousands of pixels wide. Advanced imaging SDKs are built to manipulate larger images than would normally be supported by the basic development environment, and to do so more quickly. This results in faster display times, reduced flicker during image panning, scrolling, or zooming, and other improvements that are much appreciated by end-users when viewing images. Microscopy images also tend to be very large color images, showing high detail over many cells.

Another common image series that is used in cardiology is the angiogram. Here, a series of images is displayed in a video, or cine loop, showing how a radiopaque dye travels through key arteries. The imaging software must be fast enough to decompress, scale, and display these images at the same rate as they were recorded.

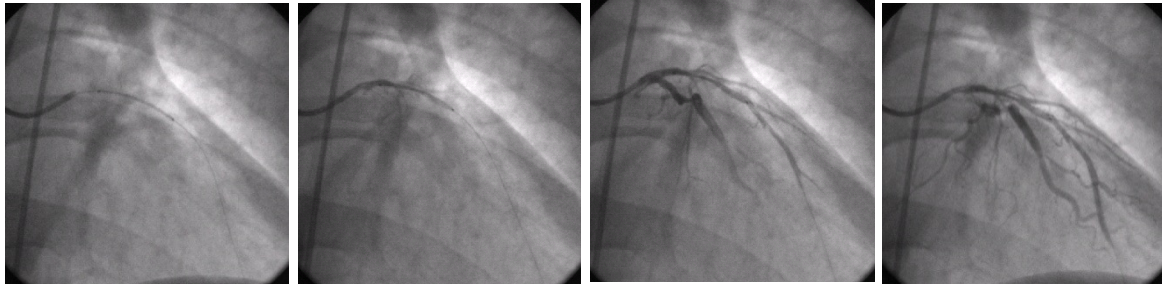


Figure 2: A few images from an angiogram video series

Patient Photos

Apart from radiology, there are visible-light images that are often desirable in EMR systems. It can be helpful to have a head shot of patients, to help identify them and to provide a more personal touch. For these photos, automatic red eye removal, image cropping, and resizing are useful features. Often, photos of skin lesions are more helpful than chart descriptions, and these photos can be made more accurate using automatic color balance or white balance along with basic image manipulation tools. Naturally, having easy format conversion and optimal compression are always useful.

Document Imaging Solutions

So far, we've concentrated on clinical applications of images. But every EMR system can benefit from increased integration and presentation of traditional paper documents. There are literally hundreds of use cases for medical documents based on imaging technologies such as scanning, image cleanup, forms processing, OCR or ICR, and barcode reading. Accusoft provides a wide variety of controls to help you add any or all of these activities to your application.

TIFF Display

The TIFF format is often used for document storage due to its excellent lossless black-and-white compression ratios. However, the TIFF format is not directly supported by web browsers. Various TIFF document viewing solutions can be built using [ImageGear](#) or [ImagXpress](#), and these documents can be viewed using browser plug-ins such as NetVue and [Prizm Viewer](#).

Scanning Solutions

When you want to add paper documents to patient files on-site, customizable scanning interfaces for TWAIN and ISIS® scanners allow you to greatly simplify the user interface. Instead of presenting several confusing options for resolution, color depth, paper sizes, and file types, for example, you might instead just present buttons that say, Insurance Card, Lab Report, and Intake Form, allowing programmatic settings for all other options. This allows your application to easily enforce consistency and quality for all document files. Controls for TWAIN scanning are available in [ImageGear](#) and [ImagXpress](#), and ISIS scanner control is available using the [ISIS Xpress](#) toolkit.

Forms Processing

For our purposes, a form is any document that contains both fixed (such as pre-printed)



and filled-in information, whether that data is added by a printer or a person. For example, patients are often asked to fill out an intake form or new patient form to provide patient contact information, family history, symptoms, etc. Lab results may be received on standard forms. Forms may be FAXed in from other providers or from insurance companies.

If you have a fixed number of different forms, you can use [FormFix](#) to determine which of many incoming document images matches a pre-defined form template. By selecting and clipping pre-defined fields for that particular form, our [SmartZone OCR](#) product can recognize machine-printed entries, or [SmartZone ICR](#) can decode hand-printed entries in those fields. Any forms that do not match any of your defined templates can be identified by FormFix for manual processing.

Conclusion

The design and development of new EMR solutions requires critical knowledge of clinical objectives and patient data relationships. The manipulation of images is a specialized area of knowledge that is very extensive and costly to reproduce and usually best implemented through third-party software development toolkits (SDKs). Accusoft offers a variety of medical and document toolkits that meet many specific needs and requirements of EMR application development. The use of any Accusoft SDK, whether individually or in combination, offers many advantages, such as standards compliance, experience and reliability, and speed. They also yield valuable benefits, such as reduced development time and costs. Don't let your EMR development worries win. Advance your EMR application development with Accusoft SDKs. Accusoft product downloads are available at www.accusoft.com. Learn more about our products and see how our toolkits can enhance your design and development today. Please contact us at info@accusoft.com for more information.

About Accusoft

Accusoft provides a full spectrum of document, content and imaging solutions. With its broad range of solutions, Accusoft is committed to deliver best-in-class, enterprise grade and fully-supported applications and a globally recognized suite of software development kits (SDKs). Accusoft products work reliably behind the scenes for capturing, processing, storing and viewing images, documents and more. Add barcode, compression, DICOM, image processing, OCR/ICR, forms processing, PDF, scanning, video, and image viewing to your applications. Products are delivered as applications and toolkits for multiple 32-bit/64-bit platforms and development environments, including iOS, Android, .NET, Silverlight, ASP.NET, ActiveX, Java, Linux, Solaris, Mac OSX, and IBM AIX. For more information, please visit www.accusoft.com.