***3rd***

***Year Project***

***Team***

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**Electronic Signup Mobile Solution**

**Research Document**

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# Area/Scope Aims

Manual form processing involves a tedious amount of human effort put in. The data keyed in by the user may result in typos, and many hours of labor result from this lengthy process.

Automated form processing reduces a number of issues associated with manual processing. They may employ a number of technologies to extract the information including optical character recognition (OCR) for machine print, optical mark reading (OMR) for check/mark sense boxes, bar code recognition (BCR) for barcodes, and intelligent character recognition (ICR) for hand print.

Automated form processing usually involves the following steps.

1. A batch of completed forms is scanned using a high-speed scanner
2. Images are cleaned with document image processing algorithms to improve accuracy
3. Forms are classified based on original template forms and the fields are extracted using the appropriate recognition components
4. Fields which the system flagged with a low confidence are queued for verification by a human operator
5. Verified data is saved into a database or exported to searchable text format such as CSV, XML or PDF

Prerequisites and limitations of automated form processing

1. Scan format: It includes the format of scanned file, Resolution and DPI, Color Mode
2. Configuration: The scanned image layout needs to be configured for this automation
3. Recognition: The pre defined out put formats
4. Result /analyze: Any specific format of result of capture value data presentation.

Nearly 70 percent of organizations acknowledge the increasing importance of mobile technologies, yet only 24 percent have any mobile-enabled processes and 30 percent are still completely reliant on paper.(AIIM 2012)

# Medical Applications

## Financial Benefits

In the United States roughly $400 billion is spent on paperwork and administrative costs. $12 billion is wasted on communication inneficiencies. (Medical Transcription n.d.)In California alone, paperwork accounts for 21% of health costs with $26 billion in administration costs. (Colliver n.d.) This is a important issue in the United States with President Obama offering $27 billion to encourage all physicians to switch to computerized medical records by 2015 as part of his 2009 stimulus package.(Chew 2011)

## Paperless Hospital

According to Slainte Healthcare, Electronic forms are of value to Nurses, Physicians, and Patients – the benefits are measurable for Medical Directors and the Hospital’s Executive Management. Forms can be completed in a third of the time they used to take, saving 66% on staff administration time, increasing the time available to direct patient care by over 10,000 hours annually in a typical facility. Additional benefits such as the increased accuracy, reduced duplication and reduced paper costs mean that the hospital benefits from direct and measurable financial savings.

Reducing paper workin hospitals can impact positively on patient satisfaction, reduce task duplication, prevent administrative errors, improve compliance and reduce costs. (SlainteHealthCare n.d.)

# Similar Systems

## ChimpaDeeDoo

Case Study : Schecter guitars adopted app to allow users to enter competition on 32 date Uproar Festival Tour.

Chimpadeedoo is a sign up app solution by MailChimp used to tie into their automated email solution service. It encorporates local storage on the device for offline use, a customisable design interface for branding purposes, ability to use hidden fields with default values, Password protection within the app to stop users accessing settings in the app while signing up and the option to send customised welcome emails to new sign ups. (MailChimp n.d.)

## SignAppNow

Simple Web based solution featuring unique URL links to access the signup sheets. Sign up data is available to download via an excel spreadsheet after the signup period expires.

This solution features editable sheets, custom URLs, Private sheets, custom sgn up fields, custom sign up groups and download sheets. (SignAppNow n.d.)

## SignUpSheet

Sign Up Sheet is a very basic form app which centres on time based forms for scheduling appointments. Its main features are the ability to send E-mail receipts and built in templates for different types of appointments, interviews etc. (MTM Recognition n.d.)

## Vitro

Vitro is a full featured application developed by Slainte Healthcare aimed at the medical industry and hospitals in particular. It has a wide scope but integral to its operation is the use of electronic forms , e-signatures and centrally accessible databases. This application aims to integrate all aspects of medical record keeping and permission acquisition by allowing for the electronic discharging patients, managing their charts and filling in drug prescription forms within a hospital with a complete audit trail. (SlainteHealthCare n.d.)

# Considered Implementation Technologies

## ASP.Net

The ASP.NET MVC platform has been chosen to provide the HTML view of the full browser web page, user authentication and to provide backend integration with the server and database. This language is one of our required Microsoft technologies as part of our entry into Microsoft’s Imagine Cup competition.

Some of the benefits of ASP.NET over other posible solutions such as PHP include a higher level of abstraction, allowing easier development in a short time period. (Microsoft n.d.) Operating in a more familiar OOP development enviroment will lead to increased productivity and a smaller learning curve. ASP.NET is also fully integrateable with Microsofts Azure service, whereas with other programming languages the Azure SDK does not include a full set of Azure APIs at present leading to more complex code when it comes to integrating. (Parker 2011)

## JqueryMobile

jQuery Mobile integrates [HTML5, CSS3](http://www.htmlgoodies.com/html5), jQuery and jQuery UI into a touch-optimized, cross platform mobile framework. It is designed to enhance development and to support a wide range of mobile platforms. Ajax support will prove invaluable to the project. For these reasons we have decided to use jQuery Mobile in combination with an Android SDK for developing a hybrid version of the application. (JQuery n.d.)

## HTML 5

HTML 5 technologies will be used in both the full browser implementation of the site and in combination with other technologies to develop the front end of the mobile application. HTML5 was developed to provide fleibility and allow more to be accomplished with stand alone HTML. Some of the major benefits associated with HTML is the addition of the canvas and video tag aswell as support for geolocation, client side local stoarage/database, offline cache and support for basic threading. (W3Schools n.d.)

## Android SDK

The app is to be developed using the Java programming language with the Android SDK as a native android app for use with both tablets and smartphones. (Android n.d.) Android development is supported cross platform between Mac OS X, Windows and Linux Operating systems through the Eclipse IDE which accomodates both members of the programming teams home operating systems. (Android n.d.)

### Captive Portals

Using tethering on the hub device would allow users to remotely connect and fill in forms remotely on their own device. This would allow multiple users to fill in a form simultaeneously saving time in crowded environments. This could be achieved by using a captive portal hosted on the hub device. (md\_5 2012)

Jetty

Jetty is a small server developed as part of the Eclipse Foundation that can be embedded in a Java program as an object, adding a HTTP module to the application rather than adding the application to a HTTP server. This is alternative option to using captive portals, or maybe be used with captive portals. (Eclipse Foundation n.d.)

### NanoHttpD

NanoHttpD is a small lightweight Server which can be embedded in Java applications. It is a basic server supplying only basic required server features without additional features such as servlet support, config files, logging or administration support. (NanoHTTPD n.d.)

## Data interchange formats

XML and JSON will be the main data formats used for communication between mobile device’s and the server. Due to limitations of mobile devices, a vast amount of apps have to transmit large amount of data over the Internet in order to deliver full functionality to the user. XML and JSON are the most common data exchange formats today and they both offer flexible and capable approaches to this problem. (IBM n.d.)

## Azure

Windows Azure is a cloud computing solution developed by Microsoft. This platform provides us with many benefits including the following:

Websites can be deployed using ASP.NET using Git or FTP, SQL Database, an API built on REST, HTML and XML, Azure integrates well with Git and Eclipse. (Microsoft n.d.)

## Subversion

Subversion (SVN) provides a single repository that all users must pull and push/commit to. All changes are slaves to the master repository and all changes are available to everyone with access to the repository immediately after saving. (Apache n.d.)

## Git

Git is a distributed version control software which allows local repositories to be branched from the master repository, meaning users have a number of repositories at any one time. (Git n.d.)

## Mercurial

Mercurial is quite similar to git in features. Like Git, Mercurial is a distributed version control software allowing local repositories to be branched from the master repository, meaning users have a number of repositories at any one time. (Mercurial n.d.)

When it came to a choice between Mercurial and git, the deciding factor came down to the culture and support community which operates areound the Git SVC.

# System Arcitechture

The applications backend will be implemented using the ASP.NET framework using an MVC architecture which separates a system into three components:

- Model – The system's data, often stored and retrieved from a database.

- View – The component that provides the UI, typically created from the model.

- Controller – This handles user interaction.

Dividing an application into separate parts makes it easier to manage and understand its complexity. Testability is also improved by separation of business logic, input logic and UI logic. Any unit testing framework compatible with .NET can be used to speed up testing process. (Microsoft n.d.)

Implementing an URL mapping feature allows for searchable and comprehensible URLs that work with representational state transfer (REST) addressing patterns and search engine optimization (SEO). (IBM n.d.)

REST is an architectural style we have decided to use in the client - server interactions. It focuses on resource states, addressing, transferring over HTTP and defines a set of principles to design a RESTfull web service as follows

1.Use HTTP methods in an explicit manner

* POST to create a new resource
* GET to retrieve a resource
* PUT to change/update a resource
* DELETE to remove/delete a resource

2. Be stateless

No session state is allowed on a server. All data required by a server to generate a response such as parameters must be included within the body and header of a HTTP request.

3. Expose directory structure-like URIs

URIs should be self-descriptive, intuitive and predictable. To achieve this an URI can be defined as a directory structure with a root and branches (sub-paths). Hiding file extensions, avoiding query strings and substituting spaces with underscores or hyphens is considered a good practice.

4. Transfer XML, JSON or both

Data exchanged between a client and a server should be kept in a simple, human-readable format.

In many cases a RESTful approach offers some benefits over other technologies:

- Caching - Resources retrieved by GET request can be cached in a number of ways.

- Scaling – Stateless approaches such as REST are easier to scale out.

- Interoperability - Does not require any toolkits, only an HTTP library.

For a mobile version of an app we have chosen a hybrid approach as the one that offers cross platform affinity by using web technologies (JavaScript, HTML) rendered by native browser rendering engine (WebKit) and presented in a full screen format.

# Hardware/Software Requirements

Hardware required:

- Tablet/Smartphone running Android OS

Software needed to develop the system is free/open source.

Windows Azure account is free(9 months for Imagine Cup contestants).

# Proof of concept

As part of our Distributed & Mobile Computing (DMC) module we chose to work with a number of technologies which would prove useful in our project.

Our DMC CA2 utilised the Android SDK through Eclipse and used HTML 5, JavaScript, JqueryMobile as implemented within a WebView to create a live map of all running trains in Ireland along with rail line layout and station markers. Other technologies which featured in this project include XML and KML. The source code management tool ‘Git’ was used to manage code as we branched and merged code, proving invaluable in handling conflicts and controlling division of work. We chose GitHub as our Git repository location for this CA to handle Forking, pull and push requests, and will continue using it for the full 3rd year project.

Throughout semester 5 we have been learning C#, Razor Sintaxand MVC technologies in our Web Design and Development module. Using ASP.Net to develop dynamic webpages that integrate and use a backend database.

As we work through the project over the course of the next few months, we will expand our current knowledge in these areas and learn to implement and integrate these technologies.

# Bibliography

W3Schools. *HTML 5 Intro.* http://www.w3schools.com/html/html5\_intro.asp (accessed December 05, 2012).

AIIM. *Process Revolution - moving your business from paper to PCs to tablets.* 11 Apr 2012. http://www.aiim.org/Research-and-Publications/Research/Industry-Watch/Process-Revolution-2012 (accessed Oct 31, 2012).

Android. *Android.* http://www.android.com/about/ (accessed December 07, 2012).

—. *Exploring the SDK.* http://developer.android.com/sdk/exploring.html (accessed December 07, 2012).

Apache. *Subversion.* http://subversion.apache.org/ (accessed December 07, 2012).

Chew, Kristina. *Enough to make you sick: The cost of Medical Paperwork.* 29 July 2011. http://www.care2.com/causes/enough-to-make-you-sick-the-cost-of-medical-paperwork.html (accessed Oct 31, 2012).

Colliver, Victoria. *Paperwork is 21% of Health Costs.* http://www.sfgate.com/business/article/Paperwork-is-21-of-health-costs-26-billion-2574761.php (accessed Oct 31, 2012).

Eclipse Foundation. *Jetty/Tutorial/Embedding Jetty.* http://wiki.eclipse.org/Jetty/Tutorial/Embedding\_Jetty (accessed December 05, 2012).

Git. *About Git.* http://git-scm.com/about (accessed December 07, 2012).

IBM. *Articles, online tutorials, and other technical resources on XML standards and technologies.* http://www.ibm.com/developerworks/xml (accessed December 03, 2012).

—. *RESTful Web services: The basics.* http://www.ibm.com/developerworks/webservices/library/ws-restful/ (accessed December 07, 2012).

JQuery. *JQueryMobile.* http://jquerymobile.com/ (accessed November 30, 2012).

NanoHTTPD. *NanoHTTPD.* http://elonen.iki.fi/code/nanohttpd/ (accessed December 05, 2012).

MailChimp. *Chimpadeedoo.* http://mailchimp.com/features/chimpadeedoo/ (accessed December 07, 2012).

Medical Transcription. *What paperwork adds to health care costs.* http://philebersole.wordpress.com/2011/07/28/what-paperwork-adds-to-health-care-cost/ (accessed Oct 31, 2012).

Mercurial. *Mercurial source control management.* http://mercurial.selenic.com/about/ (accessed December 07, 2012).

md\_5. 19 August 2012. http://stackoverflow.com/questions/12024623/android-tethering-web-server (accessed December 05, 2012).

Microsoft. *ASP.NET Overview.* http://msdn.microsoft.com/en-us/library/4w3ex9c2(v=vs.100).aspx (accessed December 03, 2012).

—. *Getting Started with Azure.* http://www.windowsazure.com/en-us/home/features/overview/ (accessed December 07, 2012).

—. *MVC.* http://www.asp.net/mvc (accessed December 07, 2012).

MTM Recognition. *Sign Up Sheet.* https://itunes.apple.com/us/app/sign-up-sheet/id461457411?mt=8 (accessed December 07, 2012).

Parker, Richard. *How to migrate your ASP.NET site to the Azure cloud.* 1 June 2011. http://www.developerfusion.com/article/119960/upgrade-your-aspnet-site-to-the-cloud/ (accessed December 03, 2012).

SignAppNow. *Sign App Now.* http://www.signappnow.com/ (accessed December 07, 2012).

SlainteHealthCare. “Solving Complex Problems in Healthcare.” *SlainteHealthcare.* http://www.slaintehealthcare.com/wp-content/uploads/Slainte-Healthcare-Company-Brochure3.pdf (accessed Oct 31, 2012).