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1 Introduction

1.1 Purpose

This document specifies the software requirements for the NGForms system. This document is intended to be an overview and guide for the future design and development of the system.

1.2 Intended Audience

This document is intended to be read by developers and testers of the software as well as the Red Cross’ managers and the Red Cross’ staff. The document expresses all agreements and features of the ideal system between all parties. It will finally also describe the limitations and scope of the project.

1.3 Definitions

IFORM file – File that specifies the definition of the form and how it will eventually be displayed in the "Form browser"

Form page – Single screen on the smart-phone that displays "form fields"

Form Generator – Desktop application that builds a "FORM file" through a UI environment. Intended for users who generate forms

Form Browser – Smart-phone application that runs and renders "FORM file". Intended for users who fill out the forms

Android – Operating system for mobile applications and also the targeted platform for the "Form browser"

AltInputs – Alternative inputs that can be used to fill out "form fields"

Form field – Single input on the "Form page"

Form Field Type – Field types of a form field (example: text fields, drop down fields, date fields, etc.)

Form Submission Server – Application that receives and processes submitted "FORM files" from the "Form Browser"
2 Overall Description

2.1 Background

The Philadelphia Red Cross emergency services provide on-site assistance for victims of disasters. The Red Cross typically assist the victims with food, shelter, and money. Currently, the assistance process relies very heavily on paper forms that are filled out by hand. Forms have to be filled out first by the Red Cross personnel at the disaster site, then the information needs to be phoned to Red Cross employees at headquarters for archiving, and finally the forms have to be mailed back to headquarters for validation, archiving, and manual entry into a database. Obviously, the current process involves handling a lot of tedious paperwork that delays the time it takes for assistance to get from the Red Cross to the victims. The Red Cross needs a streamlined automated system that allows this process to be drastically shortened.

2.2 Product Perspective

Data-form creation is certainly a topic that has been heavily developed for a number of years. Although plenty of applications allow the end users to fill out electronic forms, few have utilized the current generation of technology available to us with the advent of fourth generation smart-phones and wireless internet.

NGForms is a generic form generation application that allows easy integration of alternative media rich inputs. Instead of simple text fields, which may be more difficult to use for non computer savvy users, NGForms allows a form to be filled in by using text-to-speech, taking pictures, and handwriting. These alternative inputs will enable users to fill out the forms in a faster and more intuitive manner.

2.3 Red Cross Benefits

A benefit of a customized form filling system for the Red Cross emergency is a decrease in time it takes to fill out forms compared with their current paper form system. This decrease in form filling time is attributed to certain optimizations that the NGForms system can make from recognizing trends in how forms are filled out by the Red Cross. For instance, one of the most time consuming fields for volunteers to fill out is the disaster description field. The description dictation takes a volunteer anywhere from ten to thirty minutes because most of the time is spent writing word for word what actually happened. With an electronic system, the volunteers can theoretically speak into their smart-phone device which can process the voice input and record a transcript of the dialog - filling out the form instantly. Other optimizations that increase form filling speed for the Red Cross emergency services are "smart" pre-filling of fields based on known GPS locations and instant field validation.

Aside from optimizing form entry, another compelling need for this system is to completely erase unneeded manual data entry which involves human error. Instead of entering the forms into the database, NGForms allows the option of forms being automatically integrated into Red Cross's database as they are already represented in digital form. This drastically cuts down maintenance costs for the Red
Cross to validate database entry, eliminates form filling errors, and improves the overall workflow of their emergency system.

In summary, NGForms will help the Red Cross emergency services easily process forms and automat a process that can be very error-prone, tedious, and time-consuming.

2.4 Social Impact

A custom software application solve unique problems for customers. These applications streamline the customer’s operations with their business processes. But these custom projects are often expensive and time consuming. Organizations which cannot afford to build these applications have to suffice with lesser efficient legacy system.

The Red Cross Emergency Services is a prime example. A major part of their business process is retrieving, storing, and maintaining information. Which is currently being done by hand. Although this process could be trivially improved by leaps and bounds, they simply cannot afford such an expensive solution. Which is unfortunate considering these operations are a major bottleneck in the time it takes for aid to be received and limits the amount of victims helped.

The NGForms system aims to modernize the Red Cross's operations using the latest available technologies from networking and fourth generation phones. No longer do organizations have to store their mission critical data in paper forms, pencils, and telephones. This data is replaced by the NGForms system by xml files, smart-phones, and 3G internet speeds. This new representation of data has proven to be more reliable and maintainable than their physical predecessors.

This system will drastically reduce the costs it takes to manage their form filling process. The improvement of this process will ultimately allow the Red Cross to better use their already scarce resources to better use. Ultimately, this custom software solution allows the Red Cross help more people.
2.5 Product Scope

NGForms is intended to replace the existing Red Cross paper forms with electronic forms which are filled out by the smart-phone devices.

The delivered software to the Red Cross will consist of two components:

- *Form Generator*: See 1.3.
- *Form Browser*: See 1.3.
2.6 User Classes and Characteristics

Although the system can ideally be used by a wide range of users, it is specifically being developed with the needs of the Red Cross disaster services and its volunteers in mind. The following user characteristics reflect the characteristics of Red Cross disaster services volunteers.

2.6.1 Primary Target: Red Cross Volunteers assisting in the field

The "Form Browser" will be used primarily by the Red Cross volunteers while they are out in the field. These users tend to be retired and between fifty and seventy-five years of age. Their experience with computers is often very limited but they will be exposed to the system with some preliminary informal training. These users will want to fill out a form as quickly and accurately as possible when they are out in the field.

2.6.2 Secondary Target: Red Cross Managers

The "Form Generator" will be used solely by the Red Cross managers to create any forms that they need or to modify existing forms. Red Cross managers can be assumed to be well instructed in using the NGForms software. Red Cross managers will want to produce a form that can and will be used by their volunteers at the actual disaster sites.

2.7 Real world system environment

The mobile application will be used at disaster sites such as fires or accidents after they have settled down. These sites will have questionable internet connections but they will be the best place to record information about the disasters.

2.8 Use Case

Figure 2 - General Sequence Diagram of system
2.8.1 Form Creation

The Red Cross managers will run the "Form Generator" application. They will have to define the form properties and populate it with the appropriate fields. On each field, they can specify what kind of input the user can use. After the Red Cross staff member is finished creating the form, he can save the form into a "FORM file" and load it onto the smart-phone device to it can be rendered by the "Form browser."

2.8.2 Disaster Area form completion

Smart-phones will be preloaded with the "Form Browser" and ".FORM file(s)". The Red Cross volunteers will then run the "Form Browser." When it starts up, they will have to fill in their name and CRN number. The next screen will then give them a selection of forms that they can fill out. They will have to select the appropriate forms they want to fill out and submit them back to the Red Cross "Form Submission Server".

2.8.3 Case filing and archiving

The ".FORM file" is sent to the "Form Submission Server" for processing. The ".FORM file" will then be added to the case database which is hosted at the Red Cross Philadelphia headquarters. The System is Windows 2000 Server running Microsoft SQL Server 2003 and PeopleSoft. The Red Cross personnel can use a desktop application to query for the record they want.
3 Specific Requirements

3.1 Priorities

<table>
<thead>
<tr>
<th>Priority Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Priority 1</td>
<td>Essential requirements for a successful system</td>
</tr>
<tr>
<td>Priority 2</td>
<td>Desirable requirements for the system</td>
</tr>
<tr>
<td>Priority 3</td>
<td>Non-essential requirements, but ones that are nice to have</td>
</tr>
</tbody>
</table>

3.2 Functional Requirements

3.2.1 Entry Methods

The software will allow input fields to be filled in using "AltInputs." Each field will have a set of methods it can support.

3.2.1.1 Typing
Fields can be filled in by either physical or virtual keyboards (on screen keyboards). *(Priority 1)*

3.2.1.2 GPS
Fields can be filled in by information gathered by the device’s GPS. *(Priority 1)*

3.2.1.3 Speech to Text
Fields can be filled in by recognizing the user’s voice. *(Priority 1)*

3.2.1.4 Image Scanning
Fields can be filled in by images that are taken by the smart-phone’s camera. *(Priority 2)*

3.2.1.5 Handwriting Recognition
Fields can be filled in by recognizing the user’s hand writing. *(Priority 2)*

3.2.2 Form Files

3.2.2.1 General

3.2.2.1.1 The software will allow every form to have multiple form sections. *(Priority 1)*

3.2.2.1.2 The software will allow each form section will have multiple form fields.

3.2.2.1.3 The software will allow every field to have the capability of having multiple “AltInputs”. *(Priority 1)*

3.2.2.1.4 The software will allow every field to be tagged with a priority value. The values can be either high, medium, or low. *(Priority 1)*

3.2.2.1.5 The software will allow every field the option of specifying a default value. *(Priority 1)*

3.2.2.1.6 Fields can be marked with a validation type (See part 3.2.2.2). *(Priority 1)*

3.2.2.2 Form Validation

3.2.2.2.1 Validation Types

3.2.2.2.1.1 Non-Empty – Fields that must have a value. *(Priority 1)*

3.2.2.2.1.2 Numerical – Fields that must be numerical. *(Priority 1)*
3.2.2.2.1.3 Date – Fields that must be in the Gregorian Date Format. (Priority 1)
3.2.2.2.1.4 Member in Pre-defined – Fields that must exist in a pre-defined list – for example abbreviates must belong to an array populated by State Abbreviates. (Priority 1)
3.2.2.2.1.5 Form Characters – Fields that can only contain characters in the A-Z and 0-9 range. (Priority 1)
3.2.2.2.1.6 Numerical Field Range – Fields that have values which must be between a maximum and a minimum range. (Priority 1)
3.2.2.2.1.7 Valid Email Format – Fields that must be in a valid e-mail format (name@domain.com). (Priority 1)
3.2.2.2 If the validation fails, the user must be alerted of the error within the "Form Browser." (Priority 1)

3.2.2.3 Adding Pages to the Form
3.2.2.3.1 The software will show all of the available entry methods in an "Entry Method" panel. (Priority 1)
3.2.2.3.2 The software will display a main canvas that has a sequential list of "form pages" (Priority 1)
3.2.2.3.3 The software will allow each "form page" to display only a single data field. (Priority 1)
3.2.2.3.4 The software will allow an "AltInput" icon to be dragged into a "form page" to allow for the use of an alternative form of input. (Priority 1)
3.2.2.3.5 The software will set the "form page" entry method when the entry method is dragged over it. (Priority 1)
3.2.2.3.6 The software will display the page number on the bottom right corner of each "form page". (Priority 1)

3.2.2.4 Editing Existing Forms
3.2.2.4.1 The software will allow the "AltInput" option to be changed when the option is selected. (Priority 1)
3.2.2.4.2 The software will change the option when the "Change" button is selected. (Priority 1)
3.2.2.4.3 The software will allow pages to be rearranged and moved up and down in the total sequence. (Priority 1)
3.2.2.4.4 The software will allow pages to be removed from the total sequence. (Priority 1)
3.2.2.4.5 The software will show a confirmation popup when a page is removed. (Priority 1)
3.2.2.4.6 The software will be able to save the form project to a ".FORM file." (Priority 1)
3.2.2.4.7 The software will be able to load a previously saved ".FORM file" into the project. (Priority 2)
3.2.2.4.8 The software will allow each field to have a validation method. (Priority 1)

3.2.3 Form Browser
3.2.3.1 The software will show a welcome screen that displays a user-set logo when the application starts. (Priority 1)
3.2.3.1.2 The software will present the user with "Start New Session" and "Open Old Session" buttons. *(Priority 1)*

3.2.3.1.3 The software will allow the user to search for the form title that is entered in the search field. *(Priority 1)*

3.2.3.1.4 The software will display a list of form types when the "Start New Session" button is pressed which will be clickable buttons. *(Priority 1)*

3.2.3.1.5 The software will display a list of previous internally saved sessions will be clickable buttons, when the "Open Old Session" button is clicked. *(Priority 1)*

3.2.3.1.6 The software will display the last used form at the top of the session display. *(Priority 1)*

3.2.3.1.7 The software will allow the user to search for a form with a full world search feature. *(Priority 2)*

3.2.3.1.8 The software will render each form page on a single screen display. *(Priority 1)*

3.2.3.1.9 The software will allow the forward button to be double clicked to jump two pages ahead. *(Priority 1)*

3.2.3.1.10 The software will go back to the previous page when the back button is clicked, and go ahead one page when the forward button is clicked. *(Priority 1)*

3.2.3.1.11 The software will display the page number at the bottom of the page. *(Priority 1)*

3.2.3.1.12 The software will skip pages which have no fields to fill in (pre-filled pages). *(Priority 1)*
3.2.4 Archiving

3.2.4.1 The software will save the form session into a ".FORM file" after each page is filled in. (Priority 1)
3.2.4.2 The software will store all of the ".FORM files" in a forms folder on the device. (Priority 1)
3.2.4.3 The software will store the user's current page number in the ".FORM file". (Priority 2)
3.2.4.4 The software will proceed to the form's page number when a form is re-opened. (Priority 2)

3.2.5 Form Submission

3.2.5.1 The software will present the user with a confirmation window when the form is completed. (Priority 1)
3.2.5.2 The software will not submit the form when the cancel button is clicked. (Priority 1)
3.2.5.3 The software will transfer the form to a listening server via TCP sockets (see next note) when the OK button is clicked. (Priority 1)
3.2.5.4 The Form Submission Server will accept TCP connections and handle ".FORM files" submissions using a network protocol. (See Design Document) (Priority 1)
3.2.5.5 If an internet connection is not available the form will be stored until it is able to be submitted at a later time. (Priority 1)

3.2.6 Deployment

3.2.6.1 The form generation software will be installed with a Windows installer. (Priority 2)
3.2.6.2 The form generation software will be added into the Start Menu. (Priority 2)

3.3 Security Requirements

To ensure that each form originates from the intended user, the NGForms system will attach metadata to each form submission as well as a Form Signature Field.
3.3.1 Security Metadata

3.3.1.1 Forms submissions will contain the MAC address of the "Form Browser's" device. (*Priority 1*)
3.3.1.2 Forms submissions will contain the GPS location of the "Form Browser's" device. (*Priority 2*)

3.3.2 Form Signature Field

3.3.2.1 Forms can be signed by handwriting input. (*Priority 1*)
3.3.2.2 Forms can be signed by voice input. (*Priority 2*)

3.4 User Interface

3.4.1 Form Browser

3.4.1.1 Goals

3.4.1.1.1 Look and Feel
The Form Browser User Interface will allow form fillers a quick and easy way to enter forms on a mobile device. The UI will use the best practices of UI design as specified by http://developer.android.com/guide/practices/ui_guidelines/index.html. By following these guidelines we hope the form browser will have a native look and feel on Android devices.

3.4.1.1.2 Constant User Feedback
Due to the limited computer experience of beginner users of the "Form Browser", it will also constantly inform the user of common mistakes. This feedback will help the user quickly learn from his mistakes and better use the "Form Browser."

3.4.1.1.3 Ease of Use

3.4.1.1.3.1 The look and feel of the system should mark the instructional text and make it distinct from the regular controls so that the user can distinguish an instruction.

3.4.1.1.3.2 Each page of the form should have very few options so that the user is not overwhelmed by choices.

3.4.1.1.3.3 Controls should be large and obvious while icons should represent real world examples.

3.4.1.2 Welcome Screen

3.4.1.2.1 The main user interface is the first screen which will be displayed when the application is launched. See figure 5 for the illustration.
3.4.1.2.3 The Welcome Screen will show the NGForms logo.
3.4.1.2.4 The Welcome Screen will show three buttons.
   3.4.1.2.4.1 The first button "Open New Case" will start a new form file.
   3.4.1.2.4.2 The second button "Load Old Case" will present the user with the option of selecting a previously stored form file.
   3.4.1.2.4.3 The third button "Exit" will exit out of the application.
3.4.1.3 Open Form File

3.4.1.3.1 This opens up a new window with a list of buttons. Each one opens a different form.

![Figure 6: New case files](image)

![Figure 7: Look up old case files](image)

3.4.1.4 Forms

3.4.1.4.1 There will be four main control buttons for each form at the bottom of the screen.

3.4.1.4.2 The "Home" button will bring the user back to the application’s initial state. See Figure 5.

3.4.1.4.3 The "Forms" button will bring the user back to the forms selection menu. See Figure 7.

3.4.1.4.4 The "Next >>" button will allow the user go to the next slide of the form. See Figure 9.

3.4.1.4.5 The "<<Back" button will allow user go back to the previous slide of the form. See Figure 9.

3.4.1.4.6 The "Skip" button will allow the user to advance to the next section. This is not pictured.

3.4.1.4.7 The "Exit" button will allow user to exit the application. It will prompt the user to save the current form if the fields have only been partially filled out.

3.4.1.4.8 Form Header

3.4.1.4.8.1 The form’s title is located at the top of the form.

3.4.1.4.8.2 The form’s title has a maximum length of thirty characters.

3.4.1.4.9 Form Body

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3.4.1.9.1 The form's body will use a list of control fields that allow the user to enter the field's input using an "AltInput."

3.4.1.9.2 The form will also have the option to fill in the signature field by moving their finger around or using a stylus.

3.4.1.9.3 At the end of each form, there will be two additional buttons.

3.4.1.9.4 The submit button will send the form to the Red Cross Form Submission Servers. There is a checking mechanism that reminds the user if they missed filling out any important fields. The user can only submit the form once the fields have been correctly filled out.

3.4.1.9.5 The "Save" button will allow the user to finish the form later.

3.4.1.9.6 The general form's layout can be seen on Figure 8.
Figure 8: Form 901
3.4.2 Form Generator Application.

3.4.2.1 General

3.4.2.1.1 The main user interface will be the first screen displayed when the application is launched, see (figure 10) for the illustration.

3.4.2.1.2 The main interfaces can be broken down into the following three sections: Toolbar, Tabs, and Buttons.

![Figure 9: The application in its initial state.](image)

3.4.2.2 Toolbar

3.4.2.2.1 The toolbar will be located at the top left of the main interface.

3.4.2.2.2 The toolbar will contain the following four menu items: File, Views, Format, and Help. See Figure 10 to for a picture of all of the options expanded.
3.4.2.2.3 The file menu consists of six options to choose from: Create New Form, Open Form, Save Form, Save as, Most Recently Used, and Exit.

3.4.2.2.4 Views
   3.4.2.2.4.1 The file view menu consists of three views to choose from: General, Mobile, and Device.
   3.4.2.2.4.2 For the Android view see Figure 9.

3.4.2.2.5 The Format tab consists of three options to choose from: Font, Layout, and Background.

3.4.2.2.6 The Help tab displays the information about the software version and the developers.

3.4.2.3 Tabs
   3.4.2.3.1 The tabs are located at the right of the main interface.
   3.4.2.3.2 The tabs consist of two elements.

3.4.2.3.3 Control
   3.4.2.3.3.1 The control tab will contain a list of items that the user can drag and drop into the form field. It will be populated with the available inputs.
   3.4.2.3.3.2 The Data Source Tab will allow the user to change input data settings in the form.
3.4.2.4 Buttons

3.4.2.4.1 There will be a total of four buttons that help the user move the form around.

3.4.2.4.2 The Delete Slide button will remove the current form from the application. The program will ask the user to save the form if the form is not blank.

3.4.2.4.3 The Add New Slide button will add a new slide to the current form in the application.

3.4.2.4.4 The "<<" button will allow the user go back to the previous slide of the form.

3.4.2.4.5 The ">>" button will allow the user go to the next slide of the form.
4 Non-Functional Requirements

4.1 Hardware Requirements

The system requires the following hardware specifications:

- A machine that is capable of running .NET 2.0.
- A device capable of running the Android OS.
- Internet connectivity, preferably a 3G or 4G network.

Please note that each "AltInput" is device dependent.

4.2 Reliability Requirements

The system needs to ensure that every form is submitted back to the Red Cross servers. If the message cannot be sent then the system will need to notify the user trying to send the form; the form will then be sent whenever the system regains an internet connection again. A crash in the software should only affect the software itself and not other processes running, so a crash of the software should not warrant a restart of the device.