**Landfill Forms**

**(LF)**

**CS4962 Senior Design**

**Software Requirements Document**

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**Landfill Forms Application**

**(LF)**

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# Document Change Log

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# 1.0 Introduction

## 1.1 Purpose

The purpose of this document is four-fold:

 a) Completely define a full set of requirements for the LF (see Section 3.0)

 b) Completely define the design for the LF (see Section 4.0).

 c) Define and partially implement feasible modules for the LF (see Section 5.0).

 d) Completely define the Test Plan for the LF (see Section 6.0).

The complete definition of all Landfill Forms requirements provides the source requirement inputs for the development of the subsequent supporting software subsystems documents.

## 1.2 Scope

The documentation developed as part of the Senior Design CS4961 class, starts with the SRD including elements of Software Design and parts of a Test Plan.

The scope of this document includes the following:

* All functional and non-functional requirements on the Landfill Forms are captured. This includes Verification & Validation (V&V) requirements, as well as inter-software subsystems requirements.
* A complete set of Landfill Forms Requirements. These requirements are organized by key Landfill Forms functional units shown on the Level 1 DFD. The Level 1 DFD is shown on page
* The functional requirements defined in the Landfill Forms Requirements section have been expanded to include more specific hardware requirements.

### 1.2.1 Document Organization

The organization of this document provides a natural flow or allocation of requirements to each succeeding section.

Details regarding the overall document are given in sub-section 1.5 below.

### 1.2.2 Relationship to Other Documents

The Landfill Forms SRD is a complete self contained document. Some relationships to other documents in the literature are indicated below in sub-section 1.5.

## 1.3 Landfill Forms Architecture

### 1.3.1 Detailed Context Diagram (DFD Level 0)

The Landfill Formsarchitecture is summarized in the Context Diagram (DFD Level 0) given below. A more complete Functional Description is given in Section 2 of this document. The Context Diagram provides the overall structure of the software modules and all its inputs and outputs. The notation used corresponds to that defined for any Data Flow Diagram (DFD).



*Figure 1-1 Level 0 DFD*

### 1.3.2 Description and major functions of the Landfill Forms

LF will provide a user-friendly mobile and web application that will act as an alternative to filling out paper cluttering forms. The LF will enable the users of the application to fill out the forms using the android application and be able to upload the information on the web application. From there, the data will be stored in the database. The user will also be able to access the web application to view/generate reports.

## 1.4 Documentation Development Process

The Landfill Forms detailed functional description is documented in section 2.0. Basically, Section 2 is a succinct software description document. The overall detailed functional description is based on higher level DFDs (above level 1). All major functional units are described in detail in this part of the document.

In general, all requirements affecting Landfill Forms are captured in Section 3.0 of this document. These requirements are a refinement and completion of requirements first collected as part of this Software Engineering project. The document is cited in Section 1.2.2. This section is the one worked in most detail to become a reasonably complete Software Requirements Document (SRD). It includes both functional and non-functional software requirements together with several detailed “rational” paragraphs whenever necessary to complete the understanding of each requirement.

Section 4 includes elements of a partial implementation of Landfill Forms. This section includes the various constraints that effectively limit the implementation as well as the sub-units that will be coded. The implementation goals are defined and the code and pseudo code are included as an attachment to this section.

Section 5 is the last major section in this document and includes the overall Test Plan (TP) of the Landfill Forms. The test plan details the various techniques used to test the requirements and it also includes a Validation Matrix where each requirement specified in section 3 is listed with its corresponding validation method. The validation methods may include Testing, Analysis and Demonstration, and possible other V&V methods. In addition, the TP specifies the mandated peer reviews needed to validate the stakeholder’s part of the requirements.

## 1.5 References

All references used in the creation of this document are listed below.

### 1.5.1 Controlling Documents

1) There is no document controlling this document.

### 1.5.2 Applicable Documents

1) No additional applicable document has been used in the production of this document.

### 1.5.3 Standards

 No Standard has been used in the creation of this document. However, some Standards described in textbooks have been examined as a reference.

# 2.0 Functional Description of LF

## 2.1 Detailed Functional Description

The LF is both a mobile and web application used as an alternative to the unorganized paper form system the LA City of Sanitation has for recording Landfill information.

The mobile side of the LF is meant for the environmental compliance inspectors(ECI), its main intent is to allow the ECI to record data when they are surveying the field. The web application side of the LF is for all roles. The ECI uses the web application in order to view reports and upload their data, modify data, and receive emails. The Landfill Maintenance Staff(LMS) members and the Engineering and Management staff (EMS) are able to view reports and receive emails.

The android application is able to sync with the web application in order to gather information from the database. First, the android application will prompt the user to log in. After authorization, the ECI will be able to record information through the use of forms. After the user finishes collecting the data, the user can export this data and have it be transferred to the web application.

Initially, the web application prompts the user to log in. After authentication, the user will be able to access the application. The web application takes data that the ECI has uploaded, and uploads it to the database. Other users including the ECI will have access to the reports generated by the web application as well as auto generated emails the application sends.

### 2.1.1 Higher Level Data Flow Diagrams.

The Landfill Forms major functional design components are shown in the DFDs below. The DFDs are separated into two diagrams: a DFD representing the Android application and a DFD representing the Web application.

**Level 1 DFD Android Application**



*Figure 2-1*

### 2.1.2 Detailed Description of Landfill Forms Major Modules.

The Landfill Forms major functional sub-units shown in the DFDs in the previous sub-section, are described in detail below.

**Android Main - Module 2.1**

The Main Module for Android will be responsible for displaying data and taking input from the user, as well as access data from web application sync. It is also responsible for processing data that it receives from the web application. The main module is also responsible for managing all the modules.

**Login (Android) - Module 2.2**

In the login module (Android), the user enters their username and password. This is used for authentication purposes in order to prevent users that are not ECI from accessing the application. Upon successful login, the user will be directed to the application. Upon unsuccessful login, the user will be redirected back to the login screen. Users that are unable to login will not be able to access the application.

**Data Transfer - Module 2.3**

The data transfer module allows the android application to convert the data taken from the application and export the information into a JSON file. The JSON file contains data that the user has inputted in the from the forms module (refer to Module 2.5 for more information). The JSON file will then be uploaded to the web application and the data from that file will be stored in the database. If some information from the forms are blank, the data transfer module will notify the user that the fields are blank.

**Forms - Module 2.4**

The forms module in the android application allows the user to track and input data depending on the desired site and form. The user first selects a site and an instrument. After that, depending on the instrument chosen, the user will be directed to the form that corresponds to the instrument. The types of forms include: instantaneous, integrated, probe, IME, and warmspot. Initially, the form will display a list of grids that need attention. This depends on whether the site has been completed or not. The user can then access and create a new form. The parameters for each form varies. In the case of an instantaneous form, it will take in the grid number, start time, end time, and CH4 reading. In the case of the forms, if the CH4 reading is within a certain threshold, a notification will pop up asking them if they want to create a new form. In the case of the instantaneous form, if the CH4 reading is above 500, the application will prompt the user and ask if they want to create a new IME form. The user can also choose to create a new IME form without the need of creating an instantaneous form. The user is able to change through to a different form by changing the instrument.

**Equipment - Module 2.5**

The Equipment module displays all equipment information. The user can add, modify, and delete equipment. Some of the variables that you will be able to modify are equipment type, status, assigned site, city inventory number, and description.

**Users - Module 2.6**

The Users module will allow modification of user groups and users. Both the user groups and users are handled by the administrator. The administrator will be able to assign user groups, and each user group will have a different set of permissions. The administrator will be able to set each individual user with any amount of user groups. The user will then inherit permissions from the user groups assigned to them.

# 3.0 LANDFILL FORMS REQUIREMENTS

## 3.1 Landfill Forms Functional Requirements

This Section collects all Landfill Forms Functional Requirements. The Section includes the complete set of functional requirements with explanation and rational where the statement of the requirement was deemed insufficient or needing additional background/justification. All requirements relate to the design modules described in Section 2. An effort has been made to standardize the correlation between the design modules and the requirements to make their access and organization more consistent. For example, module 2.1 requirements are labeled 3.1, sub-module 2.1.1 requirements are labeled 3.1.1 and so on. The list of requirements follows.

|  |
| --- |
| Requirements Related to Design Module 2.1: Android Main |
| Requirement No. | Requirement Description |
| 3.1-1 |  The Android Main Module shall display data to user. |
| 3.1-2 | The Android Main Module shall take input from the user. |
| 3.1-3 | The Android Main Module shall process data it receives from the web application (WA). |

|  |
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| Requirements Related to Design Module 2.2: Login (Android application) |
| Requirement No. | Requirement Description |
| 3.2-1 | The Login module shall allow the user to enter their username and password. |
| 3.2-2 | If the user’s username and password match, the login module shall redirect the user to the application. |
| 3.2-3 | The Login module shall redirect the user back to the login screen upon failed login. |

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| Requirements Related to Design Module 2.3: Data Transfer |
| Requirement No. | Requirement Description |
| 3.3-1 | The Data Transfer Module shall allow the user export the data from the android application into a JSON file.  |
| 3.3-2 | The Data Transfer Module shall erase the data taken once export is completed.  |

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| --- |
| Requirements Related to Design Module 2.4: Forms |
| Requirement No. | Requirement Description |
| 3.4-1 | The Forms Module shall allow the user to choose which form they want to fill out, Instantaneous, Warmspot, IME, Integrated, ISE, and Probe.  |
| 3.4-2 | The Forms Module shall notify the user whether the site has been completed or not. |
| 3.4-3 | The Forms Module shall color-coat the text, depending on the CH4 reading. |
| 3.4-4 | The Forms Module shall allow the user to enter information for the specified form. |
| 3.4-5 | The Forms Module shall indicate if the CH4 reading is within range.  |
| 3.4-6 | If the CH4 reading is above a 500 for instantaneous, the Forms module will allow the user to create a new IME or add to an existing IME.  |
| 3.4-7 | If the CH4 reading is between 200-499, the Forms module will allow the user to create a new Warmspot. |
| 3.4-8 | The Forms Module shall allow the user to add the barometric pressure for their list of entries. |
| 3.4-9 | If the CH4 is over 25 for Integrated, the Forms module will allow the user to create a new ISE or add to an existing one. |
| 3.4-10 | If the CH4 readings are above 2.5% for Probe, the Forms module will alert the user to confirm the readings. |
| 3.4-11 | If the H2O pressure is above 1.0, the Forms module will alert the user to confirm the readings.  |
| 3.4-12 | For the probe form, the Forms module shall allow the user to add additional staff. |
| 3.4-13 | The Forms Module shall color-coat the text, depending on the H2O pressure reading. |

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| Requirements Related to Design Module 2.5: Equipment |
| Requirement No. | Requirement Description |
| 3.5-1 | The Equipment Module shall display a list of equipment. |
| 3.5-2 | The Equipment Module shall allow the user to create new equipment, delete equipment, as well as edit equipment.  |

|  |
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| Requirements Related to Design Module 2.6: Users |
| Requirement No. | Requirement Description |
| 3.6-1 | The Users Module shall allow the administrator to add, edit, and delete users.  |
| 3.6-2 | The Users Module shall allow the administrator to create user roles with permissions.  |
| 3.6-3 | The Users Module shall allow the administrator to assign user roles to users.  |

## 3.2 LF Non-Functional Requirements

This Section collects all the Project-Acronym Non-Functional Requirements.

NF - 1 LF requires authorization for access.

## 3.3 LF Hardware Requirements

This Section collects all the Project-Acronym Hardware Requirements.

H - 1 LF mobile application will run on a mobile device running on Android 5.0 and above.

**A. ACRONYMS**

**LF** Landfill Forms

**LMS** Landfill Maintenance Staff

**ECI** Environmental Compliance Inspector

**EMS** Engineering and Management Staff