**Requirements Analysis Document (RAD)**

**Data Gathering (DGS) System**

**for the**

**Predictive Waste Water Management System**

**(PWMS)**

**Phase 1.0**

Prepared by

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Purpose

This document is intended as a “package” agreement between development groups

Document Control

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# Introduction

This document describes the requirements, analysis functional model for the Data Gathering Subsystem of the Predictive Wastewater Management System.

## Purpose of the System

The purpose of the Data Gathering System is to configure Flow Cell, gather information from Flow Cell, store the data in Data Storage, provide alert capability for continuous monitoring of the Flow Cell as well as audit capability for retrieval of events from Audit and Alert system. Interface objects(APIs) shall be provided in order to efficiently interface with Flow Cell, to send outputs to an output interface/boundary object as well as to the Audit and Alert subsystem. Including COTS products where applicable.

In analysis modeling terms, a control object will receive inputs from the Data Gathering boundary object and will provide outputs. In other words, the Data Gatherer subsystem is comprised of Boundary and Entity Objects. Control objects shall be created/emitted from the subsystem that can be run standalone within any Java virtual machine. Authentication and authorization can be provided by the System Administrator during log in of the Data Gatherer.

## Scope of the System

### Actors

|  |  |
| --- | --- |
| **Actor Catalog** | |
| **Actor Name** | **Description** |
| FlowCell | The Eastech FlowCell participatory sensing device. It provides the data required for algorithm development and execution. |
| System Administrator | The System Administrator is an actor who adds and deletes users to and from the PWMS, assigns roles, and performs other system administration duties |
| Data Gatherer | An actor that provides (gathers) data to be analyzed by the PWMS from the FlowCells |

### Subsystems

|  |  |
| --- | --- |
| **Subsystem Catalog** | |
| **Subsystem Name** | **Description** |
| DataGathering(DGS) | The PWMS subsystem that collects the data from the FlowCell participatory sensors. |
| AccessControl(ACS) | The PWMS subsystem that assigns roles and maintains access control lists (ACLs) for the system actors and enables users to assume roles for the PWMS. Authorize and authenticate actors to access the PWMS subsystem. |
| DataStorage(DSS) | The PWMS subsystem that stores and organizes the PWMS data for use by the DataGathering, DataAnalysis, and AuditAndAlert subsystems. |
| AuditAndAlert(AAS) | The PWMS subsystem that periodically surveys the PWMS data and alerts the Watchman of a potential emergency situation. Maintains a store of audit records for the PWMS for an audit report. |

### Context Diagram



## Objectives and Success Criteria of the Project

System acceptance tests shall be created for the DGS RAD. Success of this project or shall be contingent upon the test criteria being met to the satisfaction of Eastech and Fairleigh Dickinson

## Definitions, Acronyms and Abbreviations

PWMS- Predictive Wastewater Management System

AAS – Audit and Alert Subsystem

COTS – Commercial off-the-shelf

RAD – Requirements Analysis Document

SA – System Administrator

DGS – Data Gathering Subsystem

ACS – Access Control Subsystem

DSS- Data Storage Subsystem

UML- Unified Modeling Language

## References

System Level Requirements Analysis Document for the Predictive Wastewater Management System (PWMS)

Bernd Bruegge and Allen H. Dutoit, *Object-Oriented Software Engineering: Using UML, Patterns and Java*, 3rd Edition, Prentice Hall, 2010 (ISBN 0-13-606125-7)

Jacobson, Ivar *Object-Oriented Software Engineering-A Use Case Driven Approach.* Addison Wesley 1992.

Martin Fowler, *UML Distilled: A Brief Guide to the Standard Object Modeling Language,* 3rd ed., Addison

Wesley, 2003.

Roger S. Pressman, *Software Engineering: A Practitioner’s Approach*, 7th Edition, McGraw Hill, 2009 (ISBN 9780071267823)

Black and Veatch, Smart Integrated Infrastructure White Paper, September 23, 2014.

## Overview

This document describes the requirements and the analysis model for the Data Gatherer Subsystem of the Predictive Wastewater Management System (PWMS). It provides a secure interface for the Data Gatherer to configure and manage Flow Cell.

# Current System

There is no current system in place for the PWMS. However, there are a number of applications involving participatory sensing systems and how those systems operate and can be made secure. The literature shall be thoroughly researched to leverage the state-of-the-art in implementing and securing the PWMS from unauthorized users.

# Proposed System

Our vision closely resembles the system described in the Black and Veatch Whitepaper. By employing the scenario/ use case driven approach we intend to define how end users will employ the system toward the measurement, monitoring, analysis, storage and role-enforcement functions of the PWMS.

## Overview

The Data Gathering subsystem provides a means for the Data Gatherer to configure and maintain the Flow Cells. When the data is available with the Flow Cell it is stored in the data storage and simultaneously an auditable event should be recorded in the Audit and Alert system. The Data Gathering System should be continuously monitored and any cases of discrepancies should be informed to the PWMS system as alertable events by Audit and Alert System. A framework of interfaces to Flow Cell and the other PWMS subsystems are required to accomplish it.

## Functional Requirements

1. The DGS shall allow the Data Gatherer to configure parameters during installation of Flow Cell.
2. The DGS shall allow the Data Gatherer to configure the Flow Cell of any updates or adjustments to parameters .
3. The DGS shall authenticate and authorize Data Gatherer for the PWMS.
4. The DGS shall provide a means of alerting Data Storage to store the Flow Cell data.
5. The DGS shall report Auditable Events to the Audit and Alert Subsystem (AAS).
6. The DGS shall report Alertable Events to the Audit and Alert Subsystem (AAS).
7. The DGS is administered by the System Administrator.
8. The Flow Cell shall store data to the Data Storage at regular intervals of time.
9. Auditable events are,
   1. Data Gatherer logs into the system
   2. Data Gatherer logs off of the system
   3. Data Gatherer configuring the Flow Cell parameters during installation
   4. Data Gatherer configuring the Flow Cell to update the parameters or adjustments
   5. Events such as storing Flow Cell data in Data Storage
   6. Any Alertable event
10. Alertable events are,
    1. Internal Subsystem Error.
    2. Improper working of Flow Cell
    3. Intrusion Attempt

## Nonfunctional Requirements

Nonfunctional requirements are those requirements that are not found by doing use cases or modeling but are nevertheless required for successful operation of the PWMS.

### Security

Data transmissions between DGS and other PWMS subsystems shall be secured / encrypted.

### Reliability

Flow Cell is provided with parameters stored internally, such as  Id, vertical mount, log interval, transmit interval and pipe size. These parameters help in tracking the condition of Flow Cell.

## Scenarios

### Data Gatherer Configures Flow Cell

The Data Gatherer logs into Data Gathering subsystem by providing his user name and password. The system responds by allowing access to Data Gatherer. He selects the Flow Cell to be configured. The configuration file consists of parameters such as  Pipe ID, Site location, Vertical mount, Logging interval, and Wi-Fi transmit interval. The configuration file is sent over Wi-Fi network to format the Flow Cell and set the parameters during installation. The data collected from Flow Cell at regular intervals such as distance , level, gain and a status are stored to the Data Storage. The event is recorded as an auditable event to the Audit and Alert Subsystem. In certain instances (in case of discrepancies) alerts are sent to the Audit and Alert subsystem.

### Data Gatherer Maintains Flow Cell

The Data Gatherer logs into Data Gathering subsystem by providing his user name and password. The system responds by allowing access to Data Gatherer. He selects the Flow Cell to be updated or adjusted. The updated configuration file with the required parameters will be selected and sent over Wi-Fi network to format the Flow Cell. The event will be recorded as an auditable event to the Audit and Alert Subsystem. In certain instances (in case of discrepancies) alerts are sent to the Audit and Alert subsystem.

**3.5 Use Cases**

Use cases are provided as the functional model of PWMS. The use cases are realized by tracing the event flows through the analysis model as part of the dynamic modeling process

### 3.5.1 Administer Data Gathering Subsystem

|  |  |  |  |
| --- | --- | --- | --- |
| **PWMS Use Case** | | | |
| ***Project*** | Administer Data Gathering | | |
| ***ID Number*** | DGS001 | ***Status*** | For Customer Review |
| ***Creation Date*** | 2/28/15 | ***Last Revision Date*** 2/28/15 | |
| ***Author(s)*** | Sirisha Venkannagari | | |
| ***Requirements Map*** | 7,5,6 | | |

**Description/Intent**

**T**his Use Case describes the System Administrator administering the Data Gathering Subsystem.

**Actors:** System Administrator, Audit and Alert Subsystem

**Extends:** None

**Uses:** None

**Pre-Conditions**

The Data Gathering Subsystem is operating normally.

**Post-Conditions**

The Data Gathering Subsystem is operating normally. The Data Gathering subsystem configuration is updated.

**Ideal Course of Action**

1. System Administrator logs into the Data Gathering subsystem.
2. System Administrator selects the “Configure Data Gathering Subsystem” on the System Admin dashboard.
3. A menu of configurable data is displayed.
4. Changes are made to the configurable data.
5. System Administrator selects “configure”
6. An auditable event is sent to the Audit and Alert subsystem
7. The use case ends.

**Exceptional Course of Action:** None

**Comments:** None

### 3.5.2 Authenticate and Authorize Data Gatherer

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **PWMS Use Case** | | | | |
| ***Project*** | Authenticate and Authorize Data Gatherer | | | |
| ***ID Number*** | DGS002 | ***Status*** | For Customer Review | |
| ***Creation Date*** | 2/28/15 | ***Last Revision Date*** | | 2/28/15 |
| ***Author(s)*** | Sirisha Venkannagari | | | |
| ***Requirements Map*** | 3,5,6 | | | |

**Description/Intent**

**T**his use case describes a Data Gatherer logging in to the Data Gathering subsystem.

**Actors:** Data Gatherer, Audit and Alert Subsystem

**Extends:** None

**Uses :** None

**Pre-Conditions**

The Data Gathering Subsystem is operating normally.

**Post-Conditions**

The Data Gathering Subsystem is operating normally.

**Ideal Course of Action**

1. Data Gatherer enters his credentials into the Data Gathering Subsystem.
2. Data Gatherer enters or is otherwise given access to the Data Gathering Subsystem.
3. An auditable event is sent to the Audit and Alert Subsystem.

**Exceptional Course of Action**

1. Data Analyst enters bad username or password.
2. Error message is displayed and use case returns to step 1.

**Comments:** None

### 3.5.3 Data Gatherer Configures Flow Cell

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **PWMS Use Case** | | | | |
| ***Project*** | Data Gatherer Configures Flow Cell | | | |
| ***ID Number*** | DGS003 | ***Status*** | For Customer Review | |
| ***Creation Date*** | 2/28/2015 | ***Last Revision Date*** | | 2/28/2015 |
| ***Author(s)*** | Sirisha Venkannagari | | | |
| ***Requirements Map*** | 1,5,6 | | | |

**Description/Intent:**  This use case depicts a Data Gatherer configuring Flow Cell.

**Actors:** Flow Cell, Data Gatherer, Audit and Alert Subsystem

**Extends:** None

**Uses:** None

**Pre-Conditions**

The Data Gathering Subsystem is operating normally, Data Gatherer can successfully log into the system

**Post-Conditions**

The selected Flow cell(s) configured

**Ideal Course of Action**

1) Data Gatherer selects "Select Flow Cell" button to select a particular Flow cell/ a group of Flow Cells.

2) The working condition of Flow Cell can be known with the help of status information obtained from it.

3) The Data Gatherer selects configuration file which sets the Flow Cell parameters.

4) The configuration file data is sent to the flow cells.

5) After the Flow Cell is properly configured an Auditable event is generated and the system responds with the message to the Data Gatherer as "Flow Cell Configured."

6) The Use Case ends.

**Exceptional Course of Actions**

2) If the Flow Cell is not in proper working condition then an alert able event should be generated.

3) The Use Case ends.

**Comments:**

1) The configuration file shall contain the parameters namely Pipe Id, Site Location, Vertical Mount, Logging Interval, and Wi-Fi transmit interval of Flow Cell.

2) The time interval at which data can be accessed from flow cell is set during installation by the Data Gatherer which is typically every 15 min.

**3.5.4 Maintenance of Flow Cell**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **PWMS Use Case** | | | | |
| ***Project*** | Maintenance of Flow Cell | | | |
| ***ID Number*** | DGS004 | ***Status*** | For Customer Review | |
| ***Creation Date*** | 2/28/2015 | ***Last Revision Date*** | | 2/28/2015 |
| ***Author(s)*** | Sirisha Venkannagari | | | |
| ***Requirements Map*** | 2,5,6 | | | |

**Description/Intent**: This use case depicts Data Gatherer maintaining the Flow Cell.

**Actors:** Flow Cell, Data Gatherer , Audit and Alert Subsystem

**Extends:** None

**Uses:** None

**Pre-Conditions**

The Data Gathering Subsystem is operating normally, Data Gatherer can successfully log into the system

**Post-Conditions**

The selected Flow cell(s) are updated or adjusted

**Ideal Course of Action**

1) Flow Cell required to be updated/ fixed based on requirement is selected by the Data Gatherer.

2) Required Flow Cell(s) is accessed remotely and the updated configuration file can be passed to format or adjust the Flow Cells accordingly.

3) After the Flow Cell is properly configured an Auditable event is generated and the system responds with the message to the Data Gatherer as "Flow Cell Configured"

**Exceptional Course of Actions**

1) If the Flow Cell is completely not in working condition then an alert able event should be generated.

2) The Use Case ends.

**Comments:** None

**3.5.5 Data Gatherer requests data to be stored to the Data Storage**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **PWMS Use Case** | | | | |
| ***Project*** | Data gatherer requests data to be stored to the Data Storage | | | |
| ***ID Number*** | DGS005 | ***Status*** | For Customer Review | |
| ***Creation Date*** | 2/28/2015 | ***Last Revision Date*** | | 2/28/2015 |
| ***Author(s)*** | Sirisha Venkannagari | | | |
| ***Requirements Map*** | 4,5,6 | | | |

**Description/Intent**

Data gatherer requests data to be stored to the Data Storage

**Actors:** Data Storage and Audit and alert

**Extends:** None

**Uses**

None

**Pre-Conditions**

Flow Cell in normal working condition, System is operating normally

**Post-Conditions**

Data is being stored into the Data Storage Subsystem

**Ideal Course of Action**

1. In case of explicit request to store data, Data Gathering Subsystem sends message to Data Storage Subsystem identifying the flow cells and data to be stored.
2. Audit and Alert notified.

**Exceptional Course of Actions**

1. Data unavailable from flow cells.
2. Audit and Alert notified(Auditable event).

**Comments** None

**3.5.6 Flow Cell stores data to the Data Storage**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **PWMS Use Case** | | | | |
| ***Project*** | Data gatherer requests data to be stored to the Data Storage | | | |
| ***ID Number*** | DGS006 | ***Status*** | For Customer Review | |
| ***Creation Date*** | 4/3/2015 | ***Last Revision Date*** | |  |
| ***Author(s)*** | Sirisha Venkannagari | | | |
| ***Requirements Map*** |  | | | |

**Description/Intent**

Flow Cell stores data to Data Storage

**Actors:** Flow Cell, Data Storage and Audit and alert

**Extends:** None

**Uses**

None

**Pre-Conditions**

Flow Cell in normal working condition, System is operating normally

**Post-Conditions**

Data is being stored into the Data Storage Subsystem

**Ideal Course of Action**

1. At regular intervals of time, Flow Cell stores data gathered to the Data Storage Subsystem.

2. Audit and Alert notified.

**Exceptional Course of Actions**

1. Data unavailable from flow cells.
2. Audit and Alert notified (Auditable even t ).

**Comments** None

### 3.5.7 Use Case Diagram



### 3.6 Object Model

The Object Model is represented by the Conceptual Class Diagram shown on Figure . The boundary, entity and control objects are described as follows.

### 3.6.1 SAInterface (Boundary)

SystemAdminInterface is used by the System Administrator to configure the Data Gatherer subsystem.

### 3.6.2 DataGathererInterface (Boundary)

DataGathererInterface is used by the Data Gatherer to configure and maintain Flow Cell.

### 3.6.3 ACSDGSInterface (Boundary)

This boundary interface is a shared interface with the Access Control Subsystem.

### 3.6.4 DGSDSSInterface (Boundary)

This boundary interface is a shared interface with the Data Storage Subsystem.

### 3.6.5 AASDGSInterface (Boundary)

This boundary interface is a shared interface with the Audit and Alert Subsystem.

### 3.6.6 DGSFlowCellInterface (Boundary)

This boundary interface is a shared interface with the Flow Cell.

### 3.6.7 SystemAdminControl (Control)

SystemAdminControl controls the interactions within the Data Gathering subsystem to accomplish the System Admin functions (change configuration data).

### 3.6.8 DataGatheringControl (Control)

DataGatheringControl controls the interactions within the Data Gathering subsystem to accomplish Data Gathering functions (configure, maintain, and store Flow Cell Data).

### 3.6.9 DGSFlowCellControl (Control)

DGSFlowCellControl controls interactions within the Data Gathering subsystems to accomplish the Flow cell functions and store data to the Data Storage Subsystem.

### 3.6.10 ConfigurationData (Entity)

ConfigurationData is collection of configuration data used by the Data Analysis Subsystem.

### 3.6.11 Conceptual Class Diagram



## 3.7 User Interface – Screen Mock-Ups

TBD

# Dynamic Model

The dynamic model is comprised of sequence diagrams, communications diagrams and optional state diagrams for interesting objects. The sequence diagrams correspond to each of the use cases presented in this RAD. Communication diagrams convey the same information but show more clearly the messages passes to and from each object in the object model.

## Administer DGS

This section describes the Systems Administrator configuring DGS.

### Sequence Diagram



### Communication Diagram



## Authenticate and Authorize Data Gatherer

This section describes the authentication and authorization of the Data Gatherer.

### Sequence Diagram



### Communication Diagram



## Configure and Maintain Flow Cell

This section describes Data Gatherer configuring and Maintaining Flow Cell.

### Sequence Diagram



### Communication Diagram



## Data Gatherer requests data to be stored to Data Storage

This section describes Data Gatherer requesting Data Storage to store Flow Cell data.

### Sequence Diagram



### Communication Diagram



## Flow Cell stores data to Data Storage

This section describes Flow Cell storing data to Data Storage.

### Sequence Diagram



### Communication Diagram

