SOFTWARE DESIGN DOCUMENT

FOR THE

TANK FARM INVENTORY(TFI) SYSTEM

FOR

TERMINAL SERVICES INCORPORATED

(TS Inc.)

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1 Introduction

1.1 Overviews

The overview of this document is to provide the details of requirement for the Tank Farm Inventory(TFI) System. The TFI system can provides real-time and on-line system to detect and manage the volume quantities and mass tonnage of products in tanks at the tank terminal for the whole day.This system can also fill out the tank quantities in term of volume and mass for both static and non-static tank levels.Each tank is equipped with two temperature,density,and level meter gauges.Besides that, TFI system can convert volume of products in tank in liters to mass in kilograms at Terminal service incorporated zone.This system also able to generate either text-based or web-based reports on time and demand basis.Tank Farm Inventory System can stores informations for a minimum period of 5 years.

Furthermore, The tank farm inventory system is also capable of handling the errors and exception handling for tank level reading,product temperature reading and product density reading.Besides that, it also capable of handling the rising tank levels by generating warnings and alarms when the tank level exceeded the specific amount of maximum allowable tank level.Lastly, The tank farm inventory system also able to communication with senior supervisors on duty by sending notification automatically when the warnings and alarms are being triggered. The automated notification system shall be using SMS, Email, software telegram application and software whatsapp appliation.

1.1.1 Purpose

The purpose of this document is to provide a clearer software design description for the Tank Farm Inventory(TFI) System for Terminal Service incorporated,which is a company involved in managing the tank farms, bulk chemical and materials storage terminals in Malaysia. It is a document that can be used as a reference for the further implementation of the scope of software design for the system.

1.1.2 Scope

The scope of this document is to provide the details of requirement for the Tank Farm Inventory(TFI) System. Vendors and consultants need to provide the information required to ensure the implementation of TFI system satisfied the requirement of TS Inc.

1.1.3 Intendend Audience

The document intends to provide a reference or guidance to software specialist like :

1. Software Engineer
2. Software Tester
3. Software Designer and Architect
4. Database Administrator
5. Project Manager

1.1.4 Identified Stakeholders and design concerns

The document intends to provide a reference or guidance to stakeholders like :

1. System Developer
2. Software Tester
3. Stakeholder

1.1.5 References :

1. https://www.youtube.com/watch?v=3bMsY5a7cBo&html5=1
2. https://www.ieee.org/index.html
3. https://en.wikibooks.org/wiki/LaTeX
4. http://www.visual-paradigm.com

1.2 Definitions,Acronyms,Abbreviations

1.2.1 Definitions

TBD

1.2.2 Acronyms

1. TBD : To be determined
2. TFI : Tank Farm Inventory
3. TS Inc : Terminal service Incorporated

1.2.3 Abbreviations

TBD

2 Data and Class Elements

2.1 Data elements

2.1.1 Entity Relationship Diagram

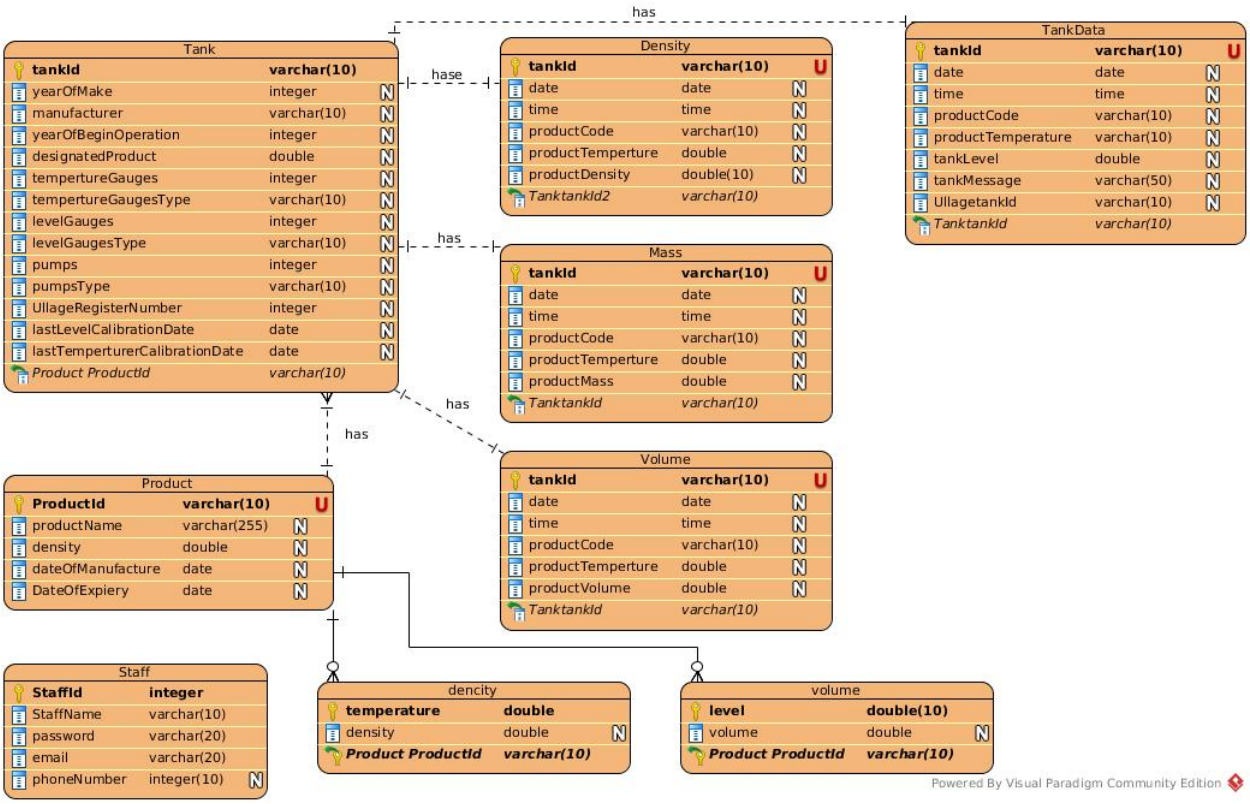

Figure 2.1: Entity Relationship Diagram for Tank Farm Inventory System.

2.1.2 Description

1. The tanks contain all the details of the tank.
2. Each tank must has volume.
3. Each tank must has mass.
4. Each tank must has tank data.
5. Each tank must has product details.
6. Each product must has density details.
7. Each product must has volume details.
8. Staff must possess with staff details.

2.1.3 Class Diagram

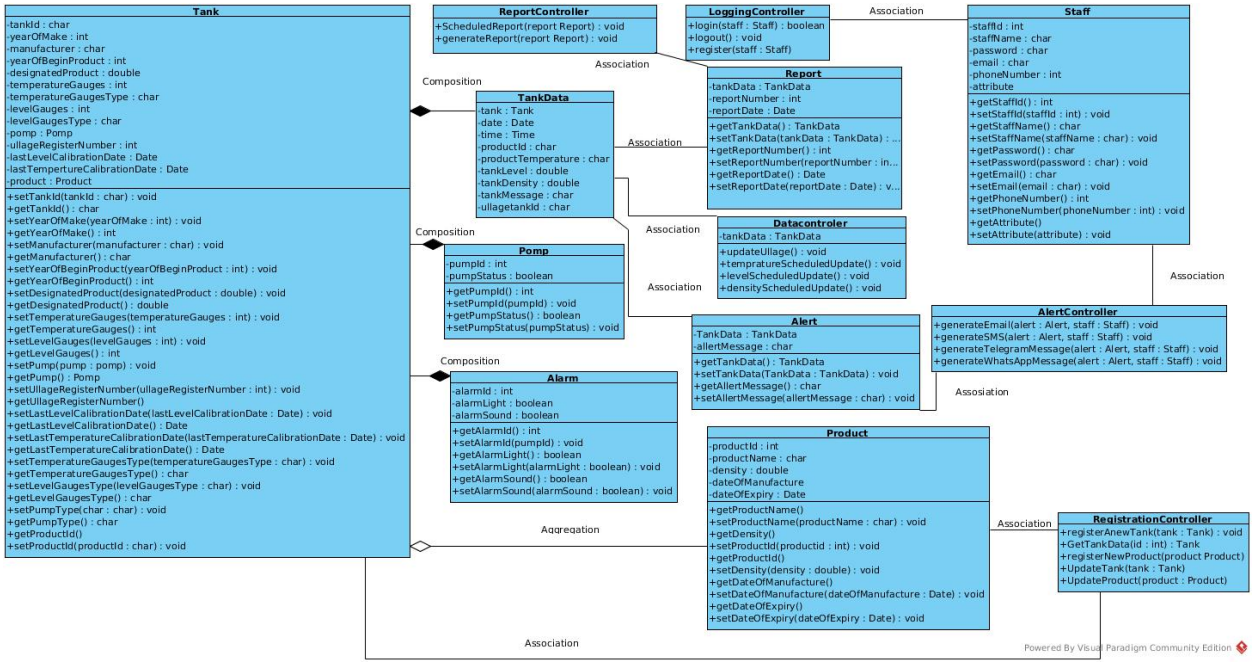

Figure 2.2: Class Diagram for Tank Farm Inventory System.

2.1.4 Description

Based on figure 2.2, Subset of the classes in this diagram are the data classes which correspond to entities in the system

- Tank : It contains the tank attributes and behaviour.
- TankData : It containssome product attributes and behavior which is in the tank.
- Pomp : Each tank has pomp and this class consists of pomp attributes and behavior.
- Alarm : Each tank has alarm and this class consists of alarm attributes and behavior.
- Product : It contains product attributes and behavior.
- Staff : It contains staff attributes and behavior.
- Report : It contain report attributes and behavior.
- Alert : It contains alert attributes and behavior.

Subset of the classes in this diagram are the class which control the process flow in the system

- Login Controller : It use to do some user process like login,logout and registration.
- Report Controller : It use to do some report like generating manual report and scheduled report.
- AlertController : It use to do some alert process like login,logout and registration.
- RegisterController : It use to do some product and tank registration and process registration.
- DataController : It use to do some update process for both manual and scheduled data.

3 System Architecture

3.1 Cassandra Database Cluster Architecture Design

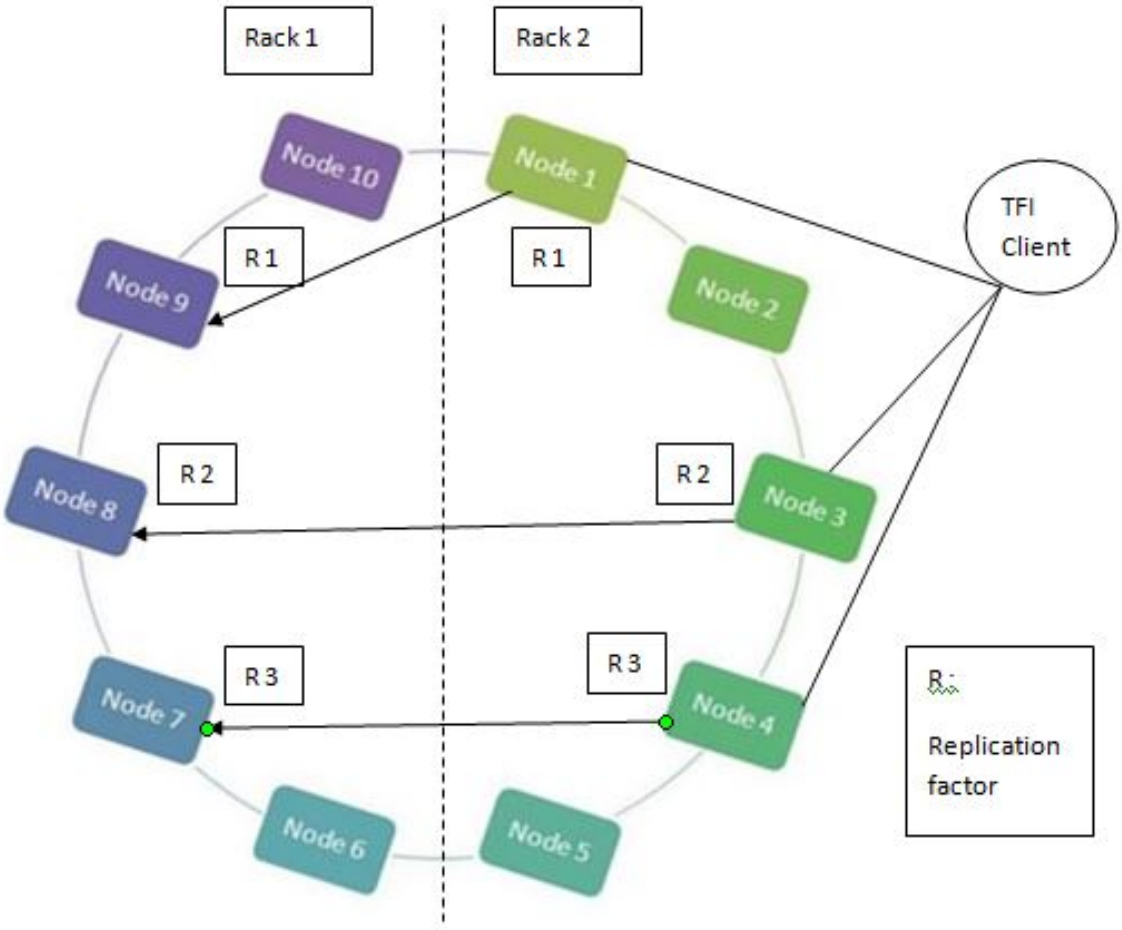

Figure 3.1: Cassandra database cluster for Tank Farm Inventory System.

3.1.1 Description

Based on figure 3.1,The cassandra database architecture design consist of 2 racks of cassandra database cluster, with each rack comprising of 5 compute-nodes.Besides that,It also design with a replication factor of 3.TFI client connects to the main node then the main node continues jumping to the other random nodes as a copy until the 3rd copy then it stops and transfer back to TFI client.

Appendices

A Design View Point

A.1 Context View Point

A.1.1 Use Case Diagram

Use Case 1

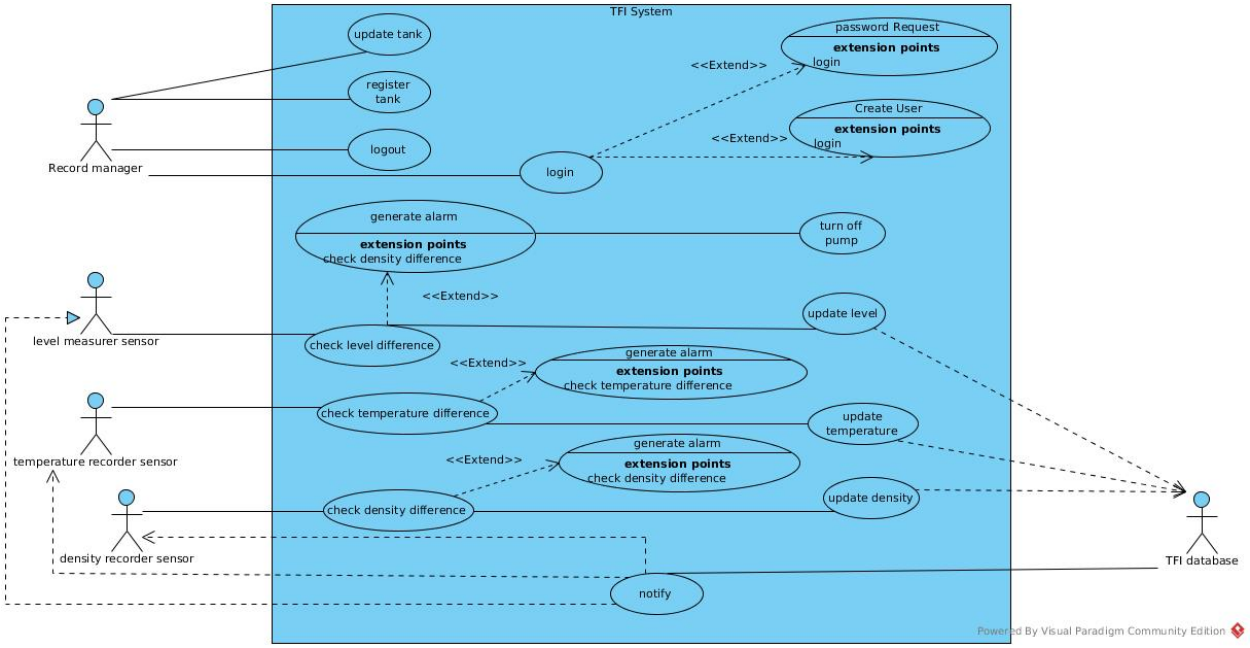

Figure A.1: 1st Use case diagram for Tank Farm Inventory System.

A.1.2 Description

Record Manager :

Use Case ID:	UC001
Use Case Name:	Update tank
Description:	This use case provides the functionality of updating Tank in the system
Primary Actor:	TFI Record Manager
Preconditions:	1.The tank must have already been verified by the staff 2.The user should already be logged in the system
Post Conditions:	The tank data should be stored in the dataset
Main Scenario :	
1.The user selects add tank option. 2.The user fills the tank information based on the physical(hard copy)data 3.The user selects to save the tank in the system 4.System shows the successful update of the tank data	
Alternate Scenario :	
TBD	

Use Case ID:	UC002
Use Case Name:	Register tank
Description:	This use case provides the functionality of registering Tank in the system
Primary Actor:	TFI Record manager
Preconditions:	1.The tank must have already been verified by the staff 2.The user should already be logged in the system
Post Conditions:	The tank data should be stored in the dataset
Main Scenario :	
1.The user selects add tank option. 2.The user fills the tank information based on the physical(hard copy)data 3.The user selects to save the tank in the system 4.System shows the successful update of the tank data	
Alternate Scenario :	
Start after step 2 in the main scenario: 1.The entered tank is already registered in the system 2.The system shows an error message "Already Registered Tank" 3.It returns to step 1 of the main scenario	

Level Measurer Sensor :

Use Case ID:	UC003
Use Case Name:	Check level difference
Description:	This use case provides the functionality of checking the level difference
Primary Actor:	Level measure sensor
Preconditions:	1.The leveler must have already been verified by the staff 2.The user should already be logged in the system
Post Conditions:	The level data should be stored in the dataset
Main Scenario :	
1.The user checks level difference. 2.The user update level 3.The user check generate alarm and decide state of pump 4.User update level into database.	
Alternate Scenario :	
Start after step 2 in the main scenario: 1.User will get notification from TFI database.	

Temperature Measurer sensor :

Use Case ID:	UC004
Use Case Name:	Check temperature difference
Description:	This use case provides the functionality of checking the temperature difference
Primary Actor:	Temperature recorder sensor
Preconditions:	1.The temperature must have already been verified by the staff 2.The user should already be logged in the system
Post Conditions:	The temperature data should be stored in the dataset
Main Scenario :	
1.The user checks temperature difference. 2.The user update temperature into database	
Alternate Scenario :	
User will get notification from TFI Database	

Density Measurer sensor :

Use Case ID:	UC005
Use Case Name:	Check density difference
Description:	This use case provides the functionality of checking the density difference
Primary Actor:	Density recorder sensor
Preconditions:	1.The density must have already been verified by the staff 2.The user should already be logged in the system
Post Conditions:	The density data should be stored in the dataset
Main Scenario :	
1.The user checks density difference. 2.The user update density into database	
Alternate Scenario :	
User will get notification from TFI Database	

Use Case 2

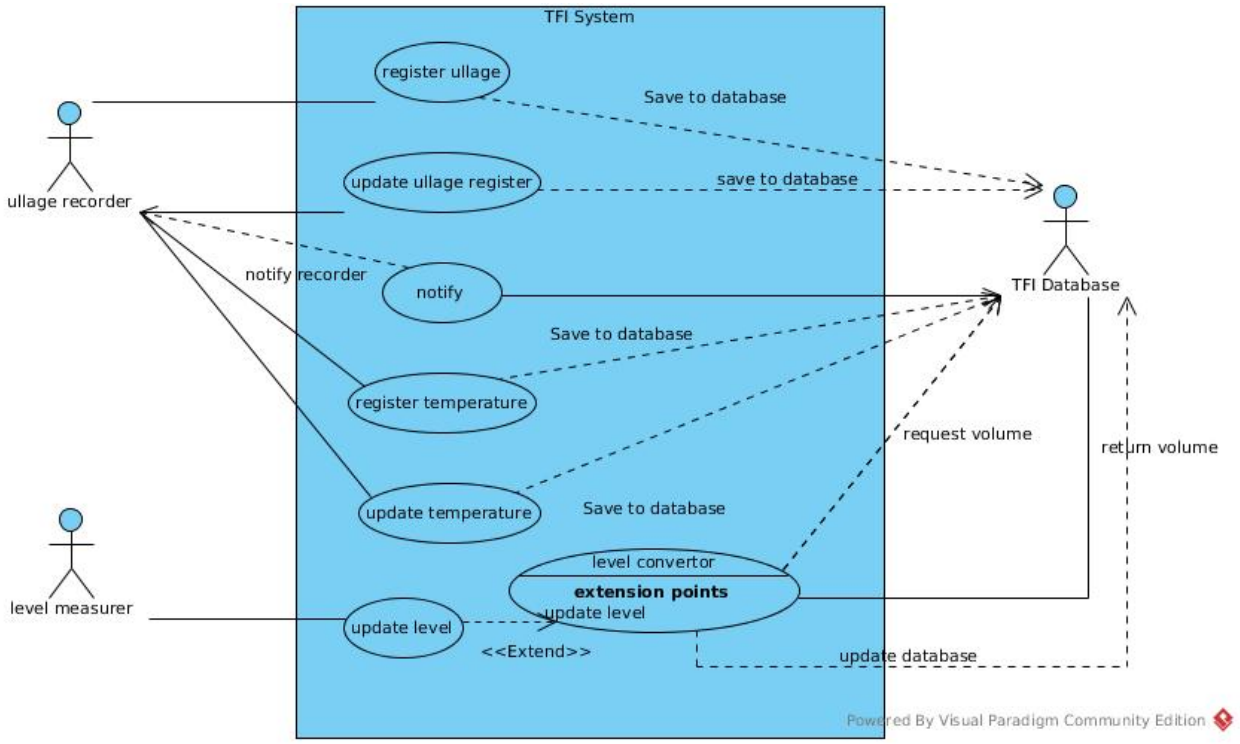

Figure A.2: 2nd Use case diagram for Tank Farm Inventory System.

A.1.3 Description

Ullage Recorder :

Use Case ID:	UC006
Use Case Name:	Register ullage
Description:	This use case provides the functionality of registering ullage
Primary Actor:	Ullage recorder
Preconditions:	1.The ullage must have already been verified by the staff 2.The user should already be logged in the system
Post Conditions:	The ullage data should be stored in the dataset
Main Scenario :	
1.The user registers ullage. 2.The data will saved to database	
Alternate Scenario :	
User will get notification from TFI Database	

Use Case ID:	UC007
Use Case Name:	Update ullage register
Description:	This use case provides the functionality of registering ullage
Primary Actor:	Ullage sensor
Preconditions:	1.The Ullage must have already been verified by the staff 2.The user should already be logged in the system
Post Conditions:	The ullage data should be stored in the dataset
Main Scenario :	
1.The user registers ullage. 2.The data will be saved to database	
Alternate Scenario :	
User will get notification from TFI Database	

Use Case ID:	UC008
Use Case Name:	Register temperature
Description:	This usecase provides the functionality of register temperature
Primary Actor:	Ullage recorder
Preconditions:	1.The temperature must have already been verified by the staff 2.The user should already be logged in the system
Post Conditions:	The temperature data should be stored in the dataset
Main Scenario :	
1.The user registers temperature 2.The data will be saved to database Alternate Scenario :	
TBD	

Use Case ID:	UC009
Use Case Name:	Update temperature
Description:	This usecase provides the functionality of update temperature
Primary Actor:	Ullage recorder
Preconditions:	1.The temperature must have already been verified by the staff 2.The user should already be logged in the system
Post Conditions:	The temperature data should be stored in the dataset
Main Scenario :	
1.The user updates temperature. 2.The data will be saved to database	
Alternate Scenario :	
1.The updated temperature will be saved into database	

Level Measurer :

Use Case ID:	UC0010
Use Case Name:	Update Level
Description:	This usecase provides the functionality of update level
Primary Actor:	Level measurer
Preconditions:	1.The level must have already been verified by the staff 2.The user should already be logged in the system
Post Conditions:	The level data should be stored in the dataset
Main Scenario :	
1.The user updates level. 2.The data will be saved to database	
Alternate Scenario :	
1.The updated temperature will be converted for volume in the database 2.Database will be updated with volume once converting done.	

Use Case 3

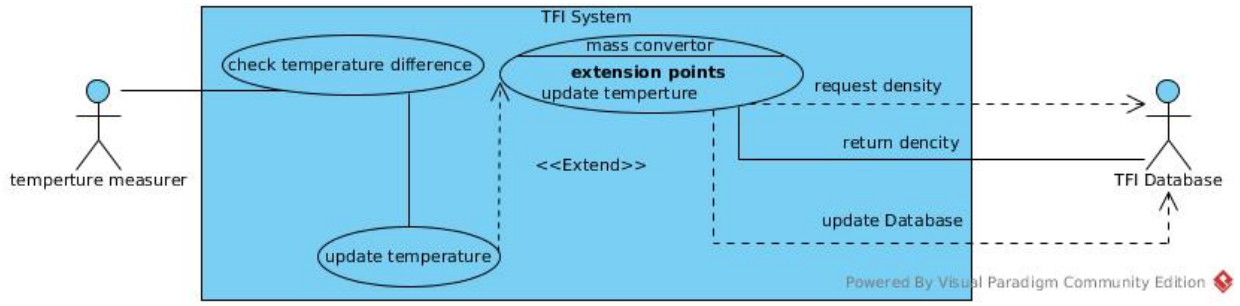

Figure A.3: 3rd Use case diagram for Tank Farm Inventory System.

A.1.4 Description

Temperature Measurer :

Use Case ID:	UC0011
Use Case Name:	Update temperature
Description:	This usecase provides the functionality of update temperature
Primary Actor:	Temperature measurer
Preconditions:	1.The temperature must have already been verified by the staff 2.The user should already be logged in the system
Post Conditions:	The temperature data should be stored in the dataset
Main Scenario :	
1.The user updates temperature. 2.The data will be saved to database	
Alternate Scenario :	
1.The updated temperature will be converted for volume in the database 2.Database will be updated with volume once converting done. 3.Database will request for density for the mass converter.	

Use Case 4

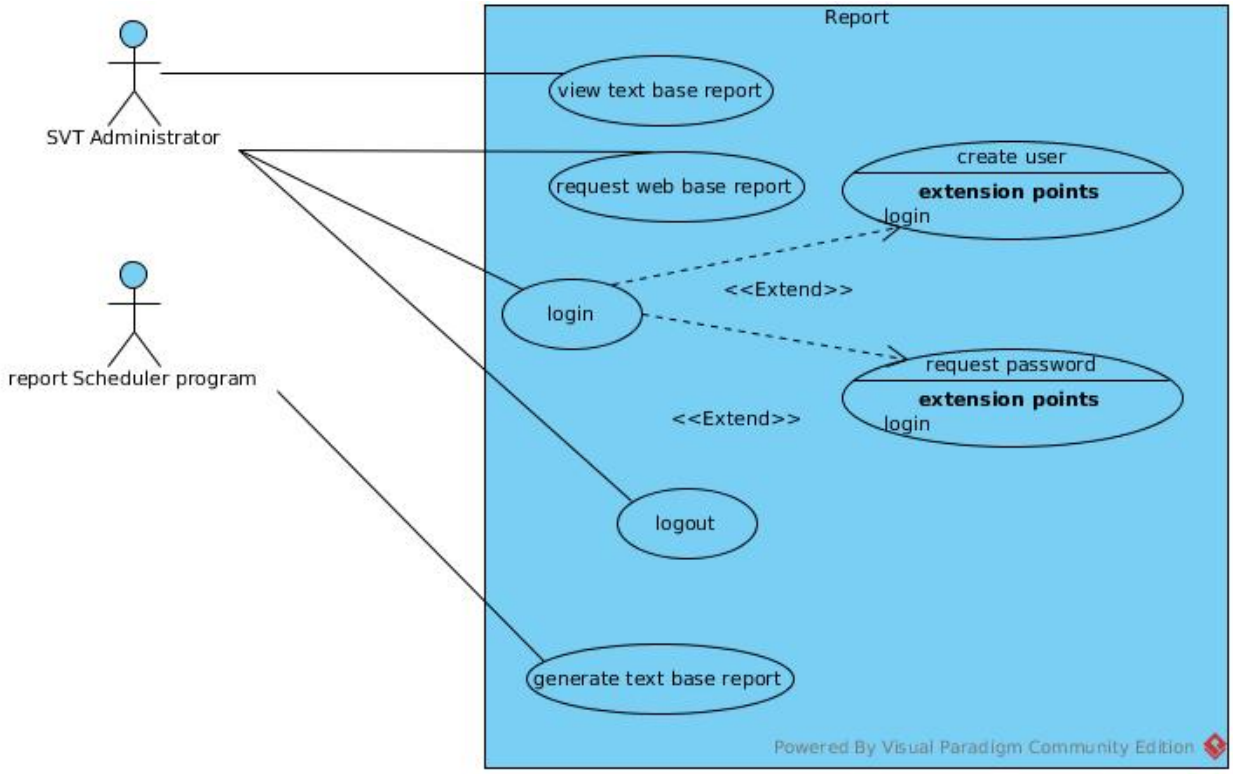

Figure A.4: 4th Use case diagram for Tank Farm Inventory System.

A.1.5 Description

SVT Administrator :

Use Case ID:	UC0012
Use Case Name:	View text based report
Description:	This usecase provides the functionality of viewing text based report
Primary Actor:	TFI Administrator
Preconditions:	1.The report is generated automatically 2.The user should already be logged in the system
Post Conditions:	
Main Scenario :	
1.The user view text based report.	
Alternate Scenario :	
TBD	

Use Case ID:	UC0013
Use Case Name:	Request web based report
Description:	This usecase provides the functionality of request for web based report.
Primary Actor:	TFI Administrator
Preconditions:	1.The report is generated automatically 2.The user should already be logged in the system
Post Conditions:	
Main Scenario :	
1.The user request web based report.	
Alternate Scenario :	
TBD	

Report Scheduler Program :

Use Case ID:	UC0014
Use Case Name:	Generate text base report
Description:	This use case provides the functionality of generating text based report
Primary Actor:	Report scheduler program
Preconditions:	1.The request is received 2.The user should already be logged in the system
Post Conditions:	Generate report based on specific details that obtained from users
Main Scenario :	
1.The program generates web based report.	
Alternate Scenario :	
TBD	

Use Case 5

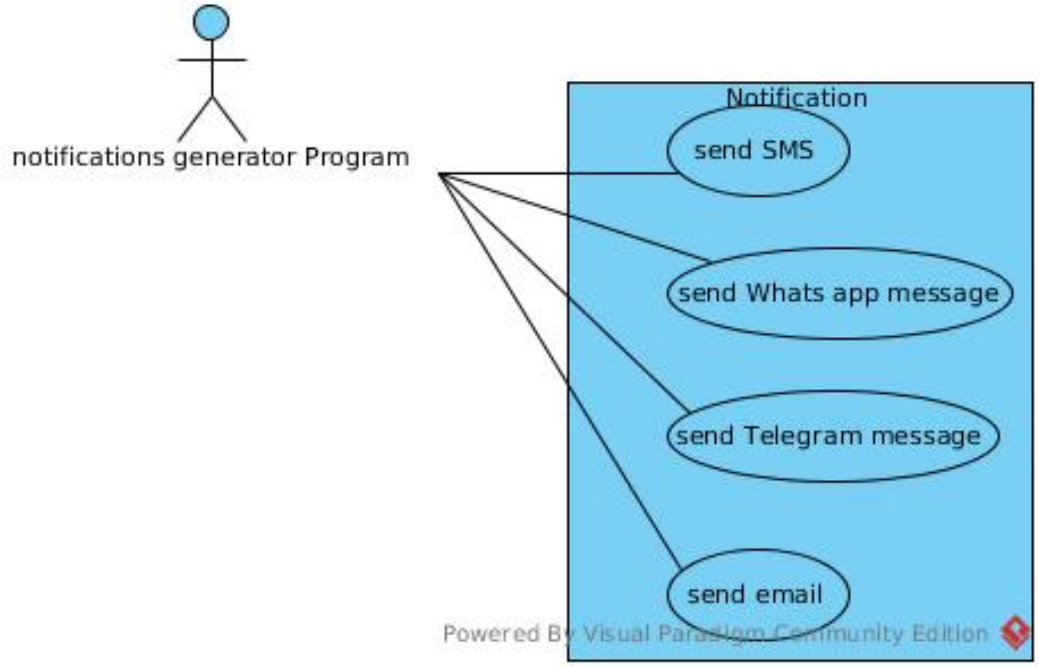

Figure A.5: 5th Use case diagram for Tank Farm Inventory System.

A.1.6 Description

Notification Generator Program :

Use Case ID:	UC0015
Use Case Name:	Notification
Description:	This use case provides the functionality of notifying user
Primary Actor:	Notification generator program
Preconditions:	1.The operation is transacted 2.The user should already be logged in the system
Post Conditions:	Generate into different form such as SMS,Whatsapp,Telegram and email
Main Scenario :	
1.The program generates notification.	
Alternate Scenario :	
TBD	

B Functional and Behavioral Designs

B.1 Interaction View Point

B.1.1 Activity Diagram 1

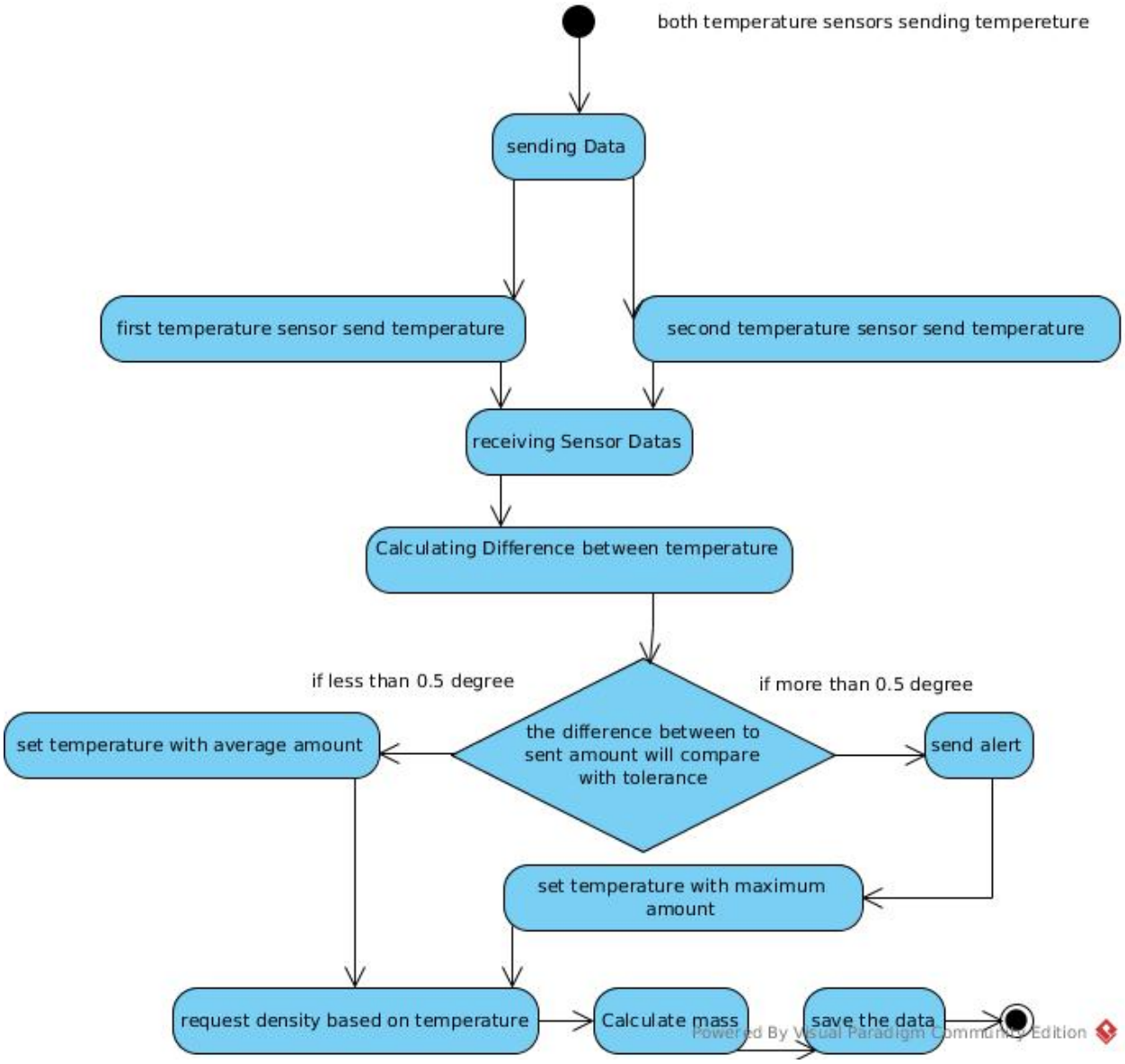

Figure B.1: Activity diagram for conversion calculation.

Description

Based on figure B.1,Two temperature sensors send the last temperatures to system and system checks differences between the amount of both.if the difference more than 0.5 degree then system send alert because of security in tank,it will set the maximum amount between them as temperature amount,else it will set the average based on the new temperature and product id.It will find the density and calculate the mass

B.1.2 Activity Diagram 2

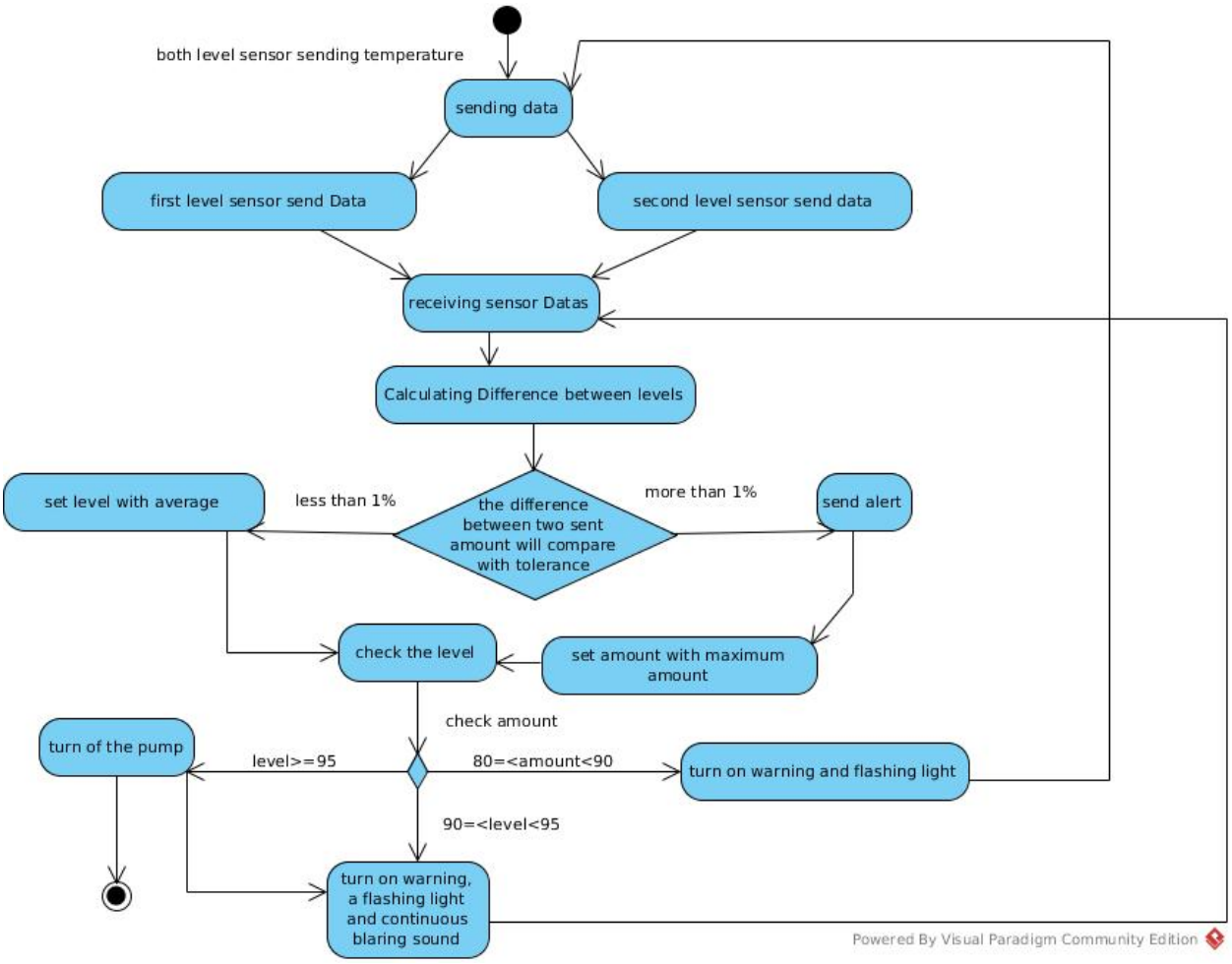

Figure B.2: Activity diagram for Handling Rising Tank Levels.

Description

Based on figure B.2,The system receive data from both level sensor. the system will calculate difference between levels. Once difference is calculated then average amount is set. The system checks the level. If the amount is more than 80 and less than 90, system will turn on warning and flashing light. If the amount is more than 90 and less than 95, system will turn on warning, flashing light and continuous sound. If the amount more than 95, the system will turn off pump.

B.1.3 Sequence Diagram 1

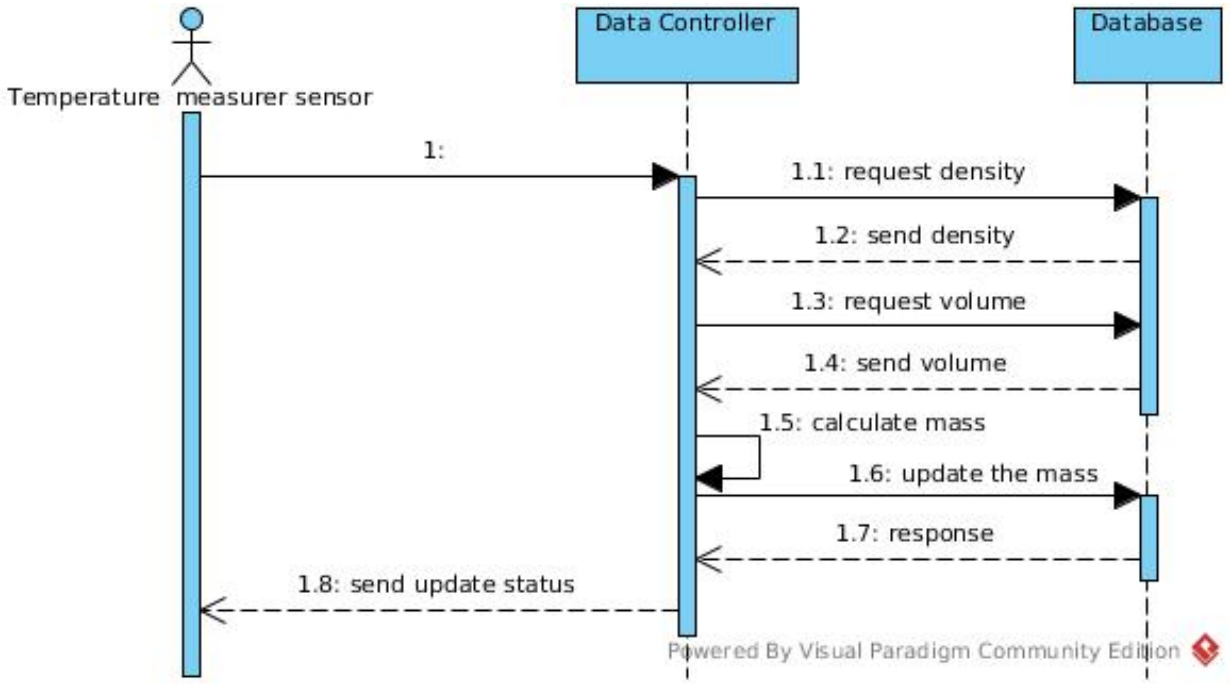

Figure B.3: Sequence diagram for conversion calculation.

Description

Based on figure B.3,The sensors will send the level .the Data Controller will check this amount and it will request the density from database, based on this density it will calculate the mass and save it to the database.

B.1.4 Sequence Diagram 2

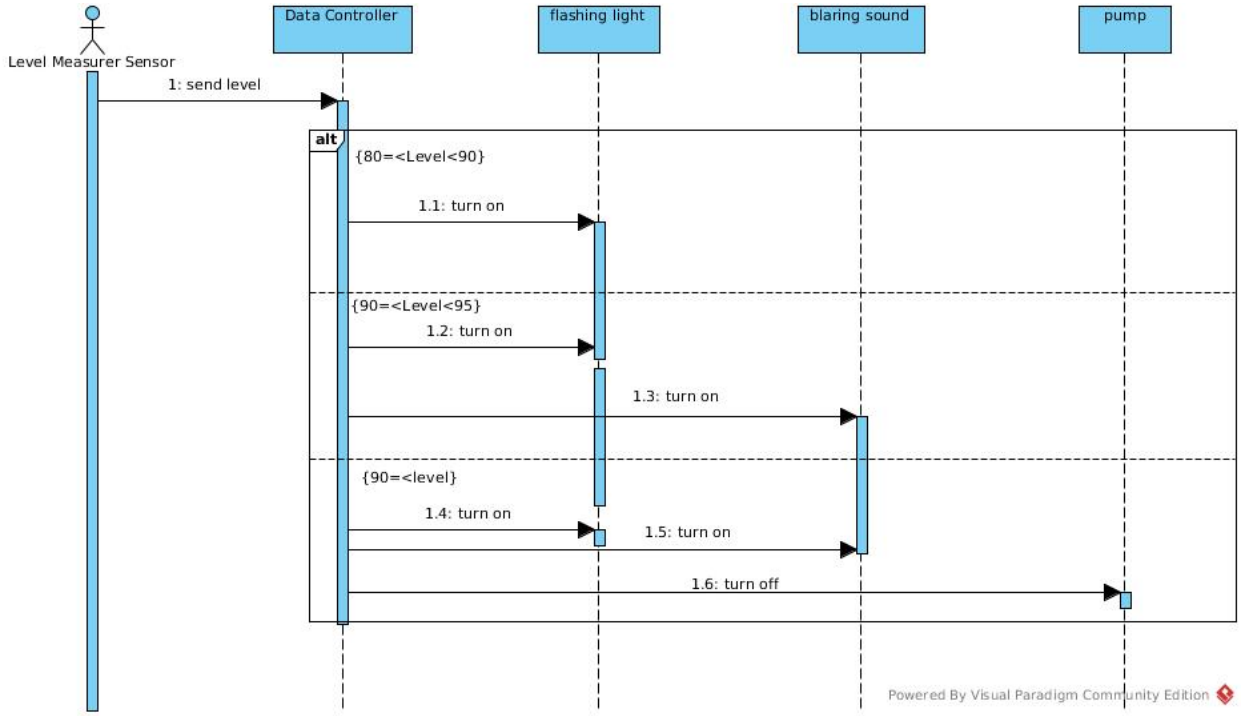

Figure B.4: Sequence diagram for Handling Rising Tank Levels.

Description

Based on figure B.4,The sensors will send the level .the Data Controller will check this amount and will turn on the flashing light if (80=<level<90),will turn on both flashing light and alarm if (90=<level<95) and at the end it also will turn off the pump.

B.1.5 Activity Diagram For Notification

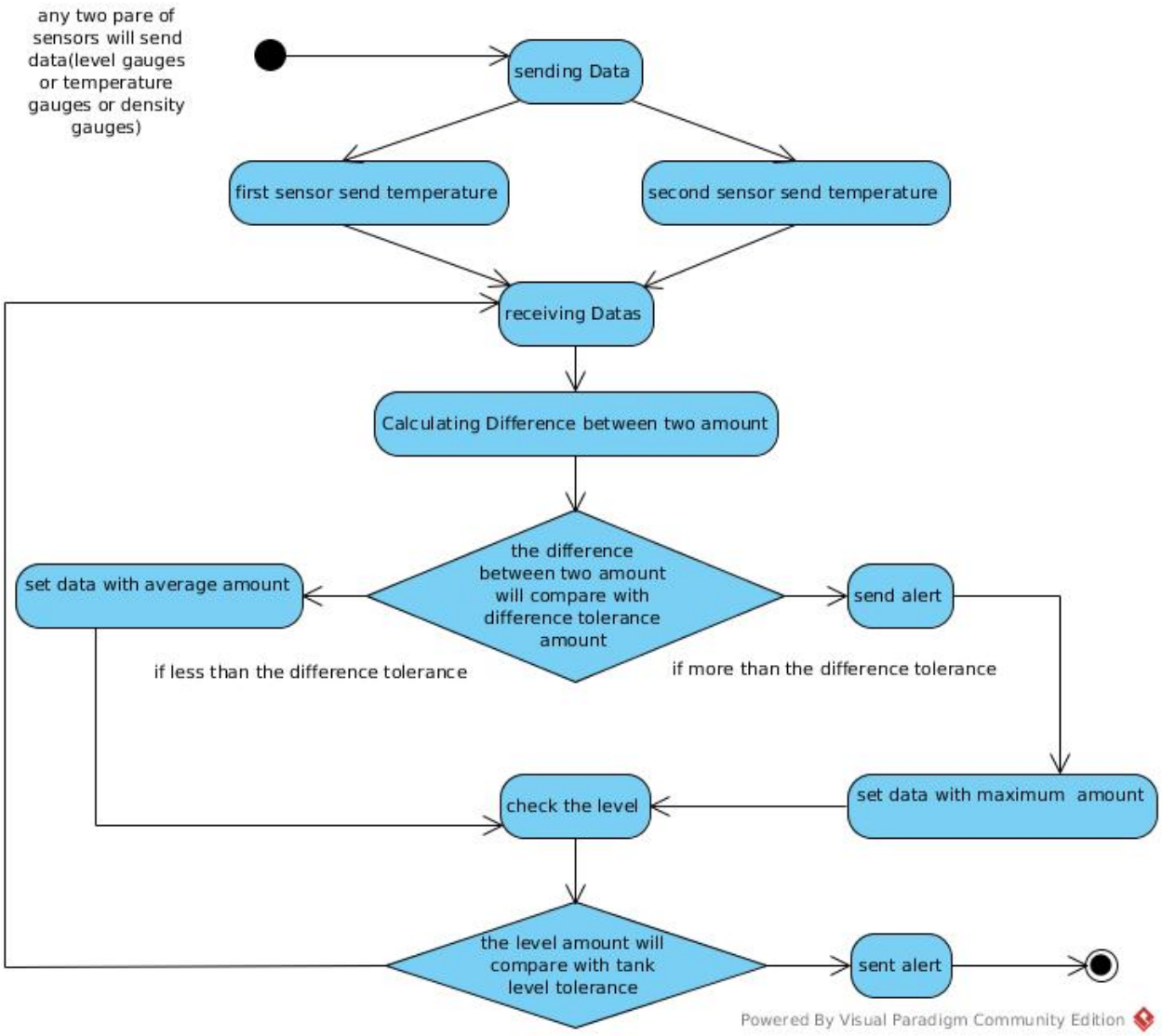

Figure B.5: Activity diagram for notification in Tank Farm Inventory System.

Description

Based on figure B.5, after any Two pair of sensors send the last data to the system. The system will check the difference between the amount of both, if the difference be more than tolerance the system will send sms, email, hats app and telegram message then because of security issue in the tank it will set the maximum amount between them as amount, else it will set the average .based in the new level amount it will compare this amount with three different situation and will send sms,email,whats app and telegram message in case of violating tolerance

B.1.6 State Dynamics View Point

State transition diagram 1

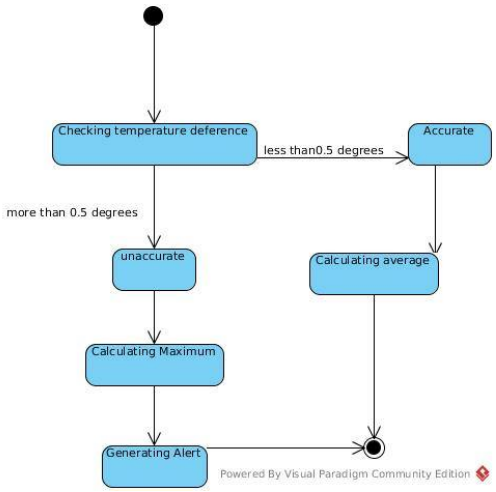

Figure B.6: State transition diagram for temperature state.

Description

Based on figure B.6,the system will check the difference and will go to accurate state in case of no violating the tolerance else will go to inaccurate state after each one will calculating maximum and generating alert.

State transition diagram 2

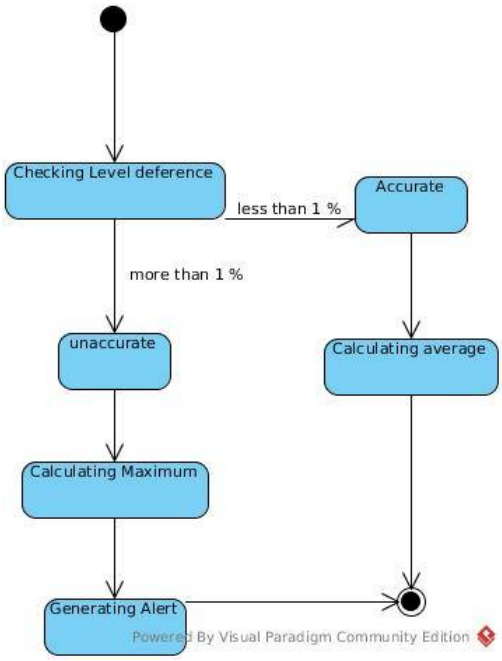

Figure B.7: State transition diagram for level state.

Description

Based on figure B.7,the system will check the level difference and will go to accurate state in case of no violating the tolerance else will go to inaccurate state after each one will calculating maximum and generating alert.

State transition diagram 3

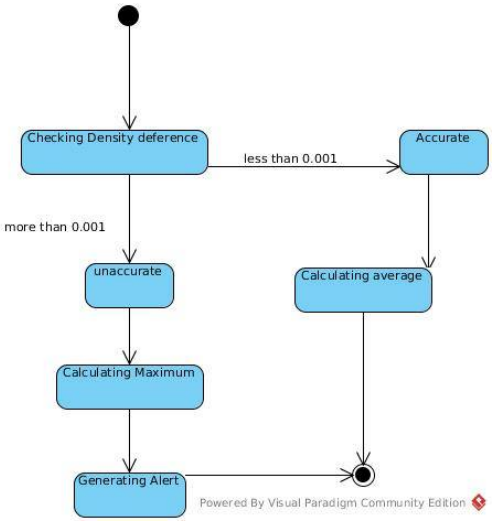

Figure B.8: State transition diagram for density state.

Description

Based on figure B.8,the system will check the density difference and go to accurate state in case of no violating the tolerance else the system will go to inaccurate state after each one will calculating maximum and generating alert.

C Change History

Version	Date	Condition	Description
1.0	02/08/2016	Added	Use Case Digram
1.0	02/08/2016	Added	Class Diagram
1.0	02/08/2016	Added	ERD Diagram
1.0	02/08/2016	Added	Class Diagram
2.0	18/08/2016	Modified and Added	Use Case Diagram and added new requirements
2.0	18/08/2016	Modified	Class Diagram
2.0	18/08/2016	Modified	ERD Diagram
2.0	18/08/2016	Added	Activity Diagram
2.0	18/08/2016	Added	State Transition Diagram
3.0	03/09/2016	Modified	Use Case Diagram
3.0	03/09/2016	Modified	Class Diagram
3.0	03/09/2016	Modified	ERD Diagram
3.0	03/09/2016	Modified	Activity Diagram
3.0	03/09/2016	Modified	State Transition Diagram