

**A Web- based petroleum products quality data converter for
Kenya Pipeline Company (KPC).**

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Group: A

An Information Systems Project **Proposal** Submitted to the Faculty of Information Technology in
partial fulfillment of the requirements for the award of a Degree in Business Information
Technology Date of Submission: January 2021

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Declaration

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the research proposal contains no material previously published or written by another person except where due reference is made in the research proposal itself.

Student Signature:

Sign: _____

Date: _____

Supervisor's Name:

Abstract

The Kenya Pipeline Company (KPC) is a state-owned cooperation which operates under the Ministry of Energy and petroleum (MoEP). The sole purpose of the companies existence is to facilitate safe storage of petroleum products and transport the petroleum products through a pipeline running from Mombasa to different depot stations within the country. The Kenya Pipeline Company, Nakuru depot, in the Quality Control department they carry out their daily operations manually which includes conversion of petroleum products and transfer the converted data into a book, The Ground-Fuel Recertification which is later manually typed into a preexisting word document which serves as the daily report form. This is extremely monotonous which can reduce staff morale especially when it is carried out every day. The proposed solution is to develop a web-based application that will automatically convert data for the different products being fed into the system and generate printable reports which can be used by management for further analysis. The development methodology to be used is prototyping this is because it revolves more around the users of the system which makes it easier to attain the user requirements.

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List of Abbreviations

OMC – Oil Marketing Companies

IK – Illuminating Kerosene

MSP – Motor Spirit Premium

RFID – Radio Frequency Identification

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Chapter 1: Introduction

1.1 Background

The Kenya Pipeline Company is a state cooperation established on 6th September 1973 under the Companies Act (CAP 486) of the laws of Kenya. The company is fully owned by the government under the provisions of the state corporations state act (CAP 446). The company's main objective is to provide safe and reliable means of storage and transportation of petroleum products in a pipeline running from Mombasa to different parts of the country, therefore, the company operates under the Ministry of energy and petroleum (MoEP) which generates policies to enable the growth of this sector. It has been discovered that, the comparison between paper-based records and electronic record systems, the electronic record system has several advantages including increased availability, long-term accessibility and automated decision support and analysis (S.N.Luxenburg). Data entry is crucial in a company operating in different industries, however, there is a possibility for human error the common types of errors include: transcription errors, words are keyed-in the wrong way or deleted and transposition errors, misplacement of numbers. These errors are costly to the organization as they may take a lot of time to discover or may lead to seeking of professional assistance to point out the error, of course, it is an expense. If the error is left out, especially for the transposition error will result to the company experiencing losses (identigate, 2018).

Entering data manually on a daily basis results to the task being monotonous, therefore, increasing the chances of making a mistake (identigate, 2018). This is the current state in which the Quality Control department at the Kenya Pipeline Company, Nakuru depot carry out their daily operations. The department is tasked with ensuring that the products being received from the pipeline are pure. To achieve this, specific tests are carried out for specific products: for diesel flash point is carried out three samples are taken and ignited and the temperature at which the flame will "flash" is recorded. The three samples are then converted and

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standardized manually into the ground fuel recertification book, distillation is the test carried out for super (MSP) where the temperature at which specific volumes are collected is recorded and converted and transferred into the ground fuel recertification book. The process is monotonous making it very susceptible to errors. Digitization is the conversion of text or images into binary code. This includes document imaging (Infognana, 2018). The accounts kept by shippers store the records of the different Oil Marketing Companies (OMC) in large files daily which becomes bulky, thus increases the time to search for a document. Digitization will: increase productivity, increase safety and security access of the document and disaster recovery (Infognana, 2018).

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1.2 Problem statement

Data entry is crucial in a company operating in a certain industry, however, there is a possibility for human error. The common types of errors include transcription errors, words are keyed-in the wrong way or deleted and transposition errors, misplacement of numbers (identigate, 2018).

The information system will minimize transposition errors by automatically performing calculations on selecting the required range and save the results for producing the daily shift report record.

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1.3 Aim

The aim is to develop an information system that will minimize the errors that occur during data entry through automation of the conversion of process of the different products tests: distillation and flashpoint. The system will also digitize previous existing physical records of Oil Marketing Companies (OMC).

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1.4 Specific Objectives

1. To investigate the challenges experienced by pipeline companies in entering converted figures into record books.
2. To evaluate the solutions that exist to provide elaborate reports in organizations.
3. To design a system that will simplify organization of records, therefore reducing the time taken to search for a record.
4. To develop and test the system.

1.5 Justification

This project will ensure data integrity is maintained throughout by having data field inputs validated from the records being entered and will notify the user if an invalid entry is made, provide the correct format of how the data is supposed to be entered. These enforced restrictions guarantee effectiveness.

The effectiveness of the validations put in place will ensure that Kenya Pipeline Company will reduce the risk of encountering losses through transposition errors during data entry and at the same time increasing productivity of employees since it is an automated process.

1.5 Scope / limitation

The project will mainly focus on verification of data entered the system. The processed data will generate reports to be used for analysis. The challenge experienced is that the main method of data collection is through firsthand collection: observation and conducting of interviews which is expensive.

Chapter 2: Literature Review

2.1 Introduction

The Kenya Pipeline Company (KPC) which operates under the Ministry of Energy and Petroleum (MoEP), Nakuru depot faces a higher risk of experiencing data entry errors such as transposition errors and transcription errors since they are calculated, entered, and stored manually which could be costly to a business when they recur on a regular basis.

The objective of this chapter is to review the technological advancements that have been utilized or are still being used, understand how they have been implemented in different industries to achieve automation, the advantages of having automated systems, challenges experienced in implementing automated systems and try to identify gaps that can be improved.

2.2 Technological advancements

2.2.1 Current technology in use

The current technology being implemented by the Kenya Pipeline Company is known as FUEL-FACS. This is a real time automated software that performs various crucial functions for example, controlling the opening and closing of valves and maintains pressure in the pipeline. The benefits of having this software is that it uses Windows NT which is compatible with most of the hardware and it generates customer invoices after a product is loaded.

"It's hard to say how much money a terminal can save by using FUEL-FACS+," says Jim Bury, Chief Operations Officer at CSI. "We installed four systems for PEMEX in Mexico and tied all four locations into one central office. FUEL-FACS+ not only dramatically improved the efficiencies of the operations, now they only need one person to handle the paperwork for all four sites. That is a huge savings in salary and benefits alone. Plus, it freed up other staff to improve customer relations and make sales calls." (oil and gas online, n.d.)

2.2.2 RFID (Radio Frequency Identification)

This is a wireless technology that automatically identifies objects without being affected by line of sight using microelectronic tags that are attached to specific objects. Technology uses radio

waves to transfer data from an electronic tag, RFID (Radio Frequency Identification) (Ajami, 2013).

2.2.3 Components of the RFID system

1. Tag - this uniquely identifies the object.
2. Antenna – creates magnetic fields for detection.
3. Reader – converts information from the tag.
4. Communication infrastructure – acts as a go between for application software and the reader.
5. Application software – interface which the users interact with.

2.2.4 Application in hospitals

The RFID technology is used to perform three critical tasks in hospitals. First is the simultaneous tracking of drugs offered to patients and the clinician who issued the drug to the patient thus reducing the amount of time involved in the follow up process and the effort. (Arab-Chadegani R, 2013).

Secondly is inventory management, it simplifies the critical process of ensuring that the supply of medicine is constantly maintained it seeks to find out what drugs are currently in stock, how much is in stock, who is tasked with distributing, where the drugs are stored and when was the last purchase done. The RFID, therefore, ascertains that drugs are available at the right place and at the right time at the time of need (Michael W.Carter, 2013).

Lastly is validation, it ensure that the patient being treated is the actual patient, the specified treatment is specifically for the selected patient. RFID technology in the medical field; reduces errors, increases productivity and aids in the development of necessary documentations that are analyzed for financial purposes or future planning. (Nm., 2004).

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2.3 Opportunities in RFID technology.

Development of a web-based application system that will integrate all the data components that have been captured to manipulate, analyze, and distribute the information for the organization to achieve higher levels of U-commerce.

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Chapter 3: System Development Methodology

3.1 Introduction

Methodology refers to the different approaches that are used to conduct research or develop a system. This chapter seeks to identify which methodology is suitable for this project by considering factors such as: goals, quantitative/qualitative, sample size and timing.

3.1.1 Goals

The end goal of the research will determine the design. The goal of this system is to ensure that the user requirements are completely satisfied to attain this constant user involvement is necessary.

3.1.2 Quantitative and qualitative

Quantitative uses numbers and graphs to confirm theories and assumptions while qualitative uses words to grasp concepts, therefore providing deeper insights.

3.1.3 Sample size

The size required to attain answers to the research question. The sample size to be used in the gathering of information is few.

3.1.4 Timing

This determines the relevance of data collected within a given period. If results are needed within a short period, techniques such as sampling are used, whereas, if it is a long period, techniques such as conducting interviews.

Therefore, having considered the above factors the development methodology selected is prototyping.

3.2 Prototyping

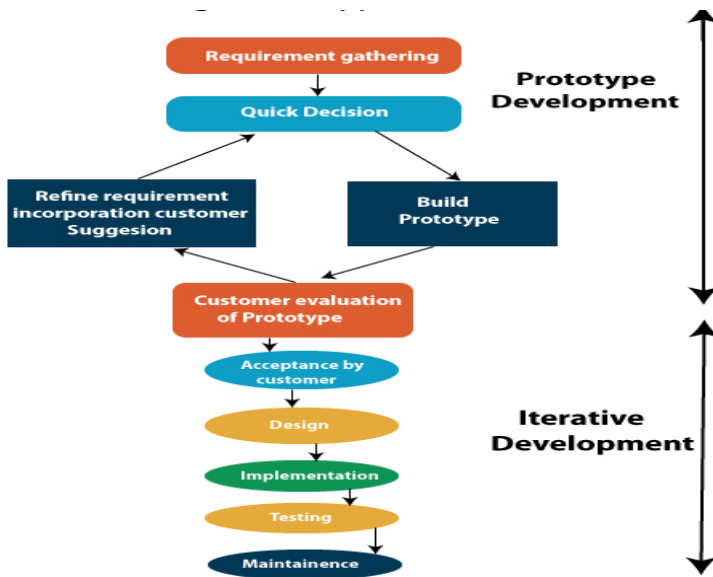


Figure 1: Prototype Model

Prototyping a model refers to developing a working template that will be able to familiarize the users of the systems with a basic working idea of how the system will work. The prototype is a basic representation of how the actual system will look like, therefore the developers and the users work hand in hand, repeatedly adding desired functionalities to satisfy every user need.

3.2.1 Requirement gathering

Information is obtained from the users using different data collection methods.

3.2.2 Quick design

Only important aspects for developing the system are recorded from the information provided by the user.

3.2.3 Build prototype

A working model of the actual system is developed.

3.2.4 User evaluation

The prototype is presented to the user to provide more specifications on what should be added or removed from the prototype.

3.2.5 Refine requirement.

The requirements are altered and implemented into the new prototype depending on the user specification. This stage is highly repetitive, because it must satisfy all the user requirement to proceed to the next stage.

3.2.6 Design

The actual system technicalities are put into place at this stage; risks, technologies to be used, team, time and budget.

3.2.7 Implementation

Coding of the actual system begins at this stage, depending on the approved user requirements.

3.2.8 Testing

Developers inspect the code to see if the developed system executes seamlessly as per the given requirements by the user.

3.3 Analysis

The project will apply Structured System Analysis and Design (SSAD) approach. There are several reasons for using this approach, but the focus will be on two major reasons; the user is deeply involved in the development process, thus, ensuring that the user requirements are completely met, and this approach divides the project into modules which have specific objectives which makes it easier to understand for both the developers and users.

3.3.1 Functional requirements

These are the must have modules in the system that ensure the developed system meets its intended purpose.

1. Authentication of technicians
2. Petroleum products conversion calculations
3. Generating daily petroleum products reports
4. Storage of petroleum products records
5. Data manipulation (CRUD).

3.3.2 Non-functional requirements

These refer to the additional features included in the system to ensure smooth running of the system.

1. Ease of use
2. Reliability

3.4 System development tools and techniques

3.4.1 IDE

The Integrated development environment to be used will be atom because of the familiarity, auto completion and can be used in different operating systems.

3.4.2 DBMS

The Data Base Management System (DBMS) to be used will be phpMyAdmin because of its ease of use as it has a user-friendly interface.

3.4.3 Programming languages

Being a web-based system, the preferred programming language will be html to provide structure of how components will be placed on the web page, JavaScript to add functionality to the webpage for example perform mathematical operations and php.

3.5 Test method of the system

Black box testing will be used as the method of testing for this system. Mainly because black box testing only focuses on the processed output data rather than the code used to generate the data. This is crucial for the system being developed as it is a mathematical converter for petroleum products which is highly dependent on what is being fed into the system and the output regardless of the code.

3.6 Domain of execution

Having a web-based system that runs on the organizations intranet will be beneficial to the organization as it will ease the access and spread of information throughout the entire organization.

3.7 Proposed modules and System Architecture

A module is simply a breakdown of the system into individual components that perform specific functionalities to achieve a common goal.

3.7.1 Registration module

Will contain the sign-up form for new users and a login form for existing users. Main objective is to control access.

3.7.2 Products module

This module will contain the different petroleum products forms; diesel, super (MSP) and kerosene where the user can input the quantities which are automatically converted.

3.7.3 Report module

Generation of reports will take place in this module the daily recordings from the products module will be converted to PDF format for printing.

Chapter 4: System Analysis and Design Description

4.1 Introduction

The aim of this chapter is to give a clearer description of how the system functions by use of diagrams. It also explains the different data collection techniques used to gather the requirements needed for development. Finally, a diagrammatic representation of how different users can interact with the system.

4.2 Requirement gathering

There are different methods of gathering requirements but for the purposes of this project the focus was on three main techniques: observation, questionnaires and conducting interviews.

Observation was used in the early stages during the induction stage in the organization where interns were shown how different departments carried out their daily operations. In the quality control department, the requirements gathered were how quality checks were done for different petroleum products and the formulas used. It was noted that most of the mathematical conversions were done manually which increases the chances of human errors occurring necessitating automation of the process.

The interview conducted was used to understand the different reports generated: daily shift report, product report and shift report after the quality check process of the petroleum products also how the reports were filled in was captured.

4.3 System requirements

Categorized into two: functional requirements and non-functional requirements.

4.3.1 Functional requirements

These are the must have modules in the system that ensure the developed system meets its intended purpose.

FR1	The system should allow log in
FR2	The system should sign up
FR3	The system should perform quality check calculations
FR4	The system should generate reports
FR5	The system should store records
FR6	The system should allow data manipulation (CRUD)
FR7	The system should validate data entered

Table 1: Functional requirements

4.3.2 Non-functional requirements

These refer to the additional features included in the system to ensure smooth running of the system.

NFR1	The system should be easy to use by implementing simple interfaces.
NFR2	The system should be reliable by ensuring that confidential data is secured.
NFR3	The system should be able to perform efficiently.
NFR4	The system should be secure by use of security techniques such as hashing of passwords.

Table 2: Non-functional requirements

4.4 System Architecture

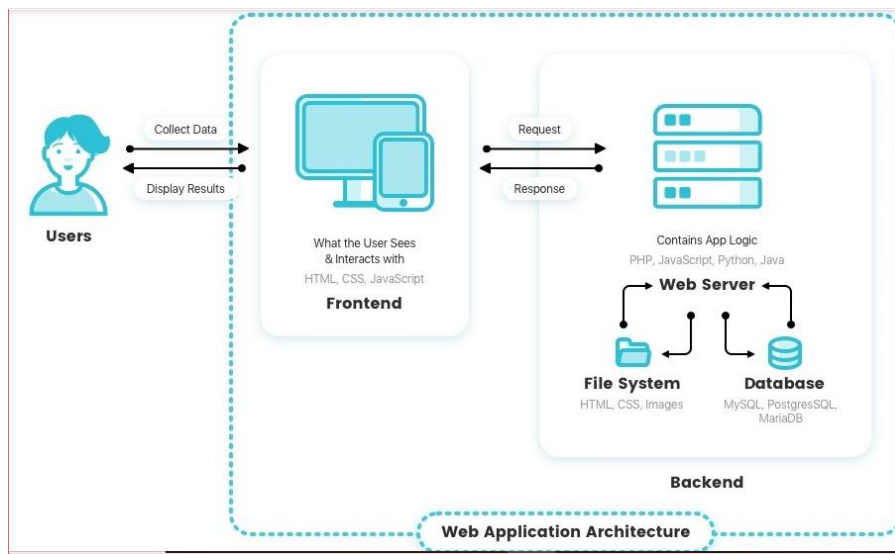


Figure 2: Web application architecture

4.5 Analysis

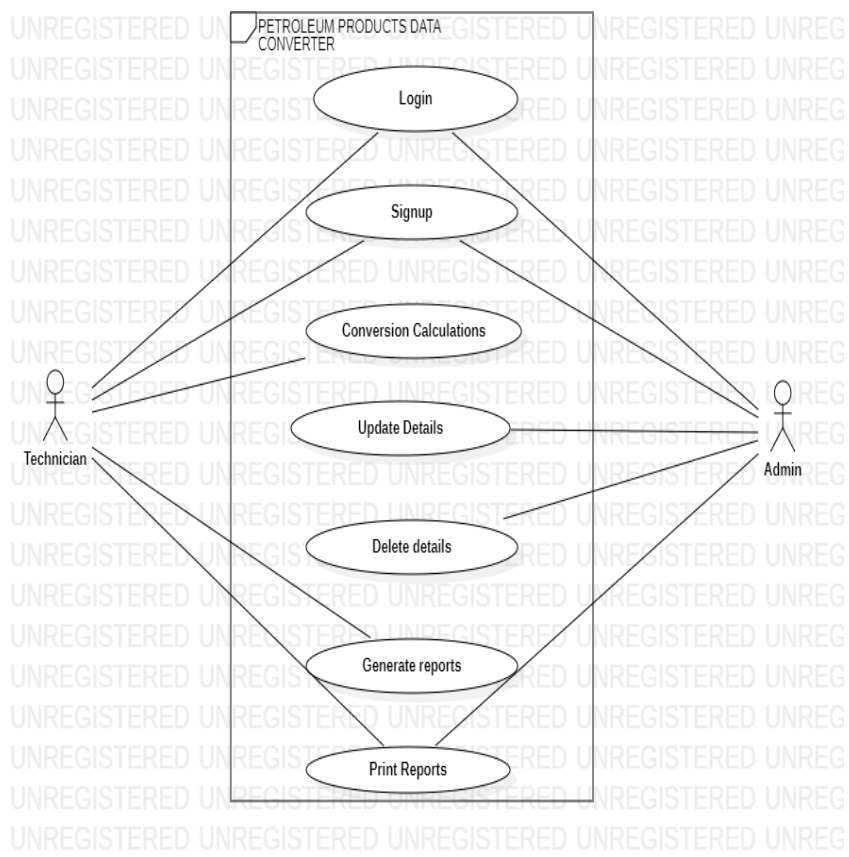


Figure 3: Use case diagram

4.6 Design

4.6.1 Context Diagram

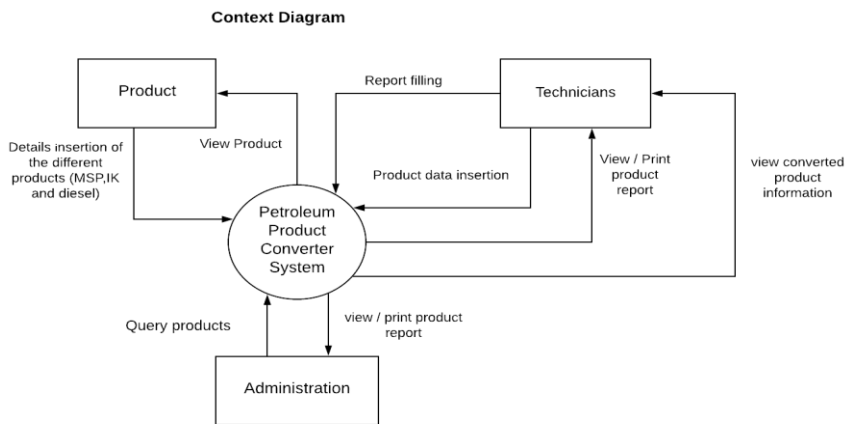


Figure 4:Context diagram

4.6.2 DFD 1

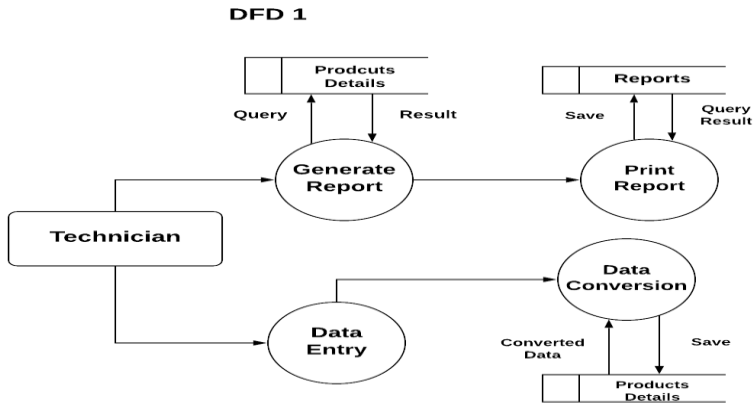


Figure 5:DFD 1

4.6.3 DFD 2

DFD Level 2

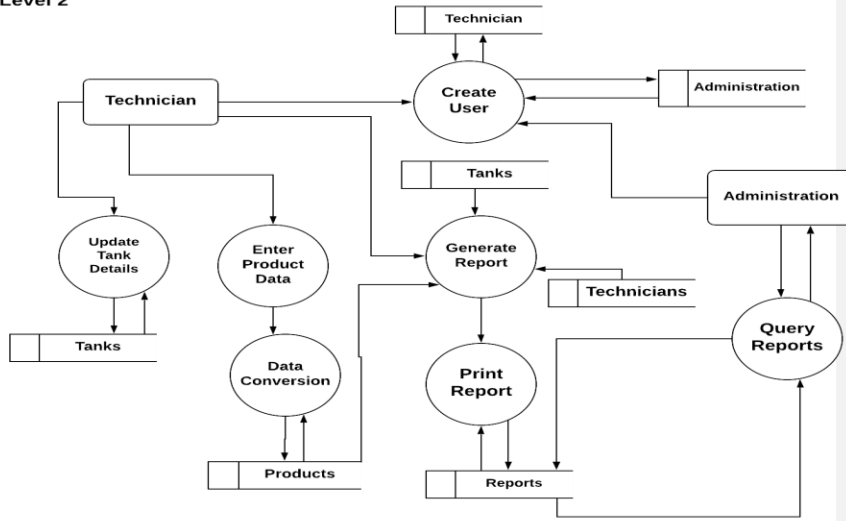


Figure 6:DFD 2

4.6.4 ERD

|

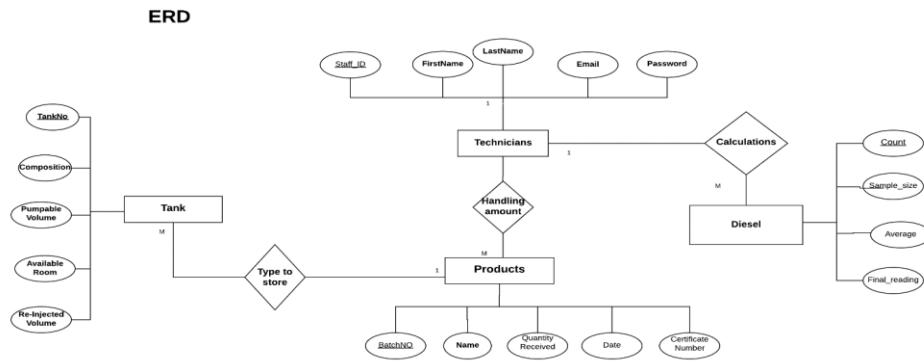


Figure 7:ERD

4.6.5 Database Schema

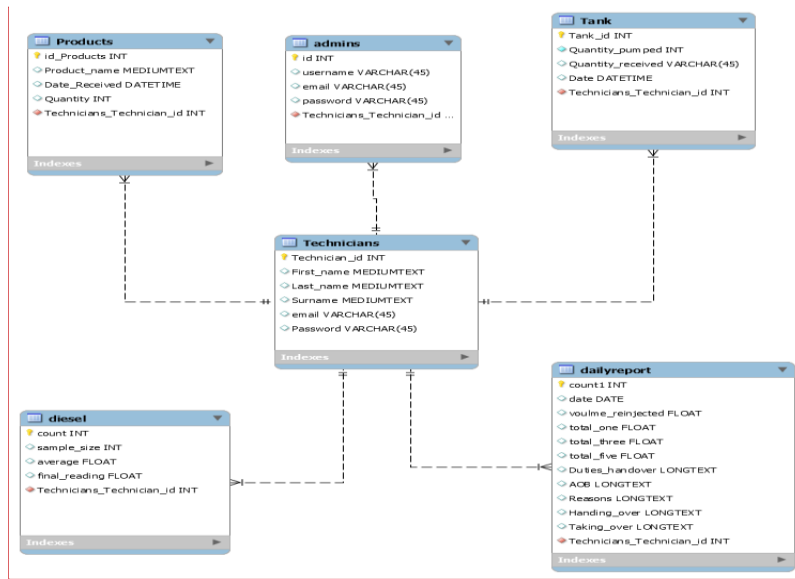


Figure 8: Database schema

Chapter 5: System Implementation and Testing

5.1 Introduction

The aim of this chapter is to prove that the system works seamlessly, showing tests performed on different modules of the system together with a diagrammatic user manual that not only helps the user navigate through the system easily and understand the functions of the modules but also be able to install the system easily into their computers. This will be clearly illustrated in the sub-sections below.

5.2 System Implementation

5.2.1 Installation procedure

5.2.1.1 Xampp installation

This is the first step in the installation process. Download the Xampp software from <https://www.apachefriends.org/download.html> and select the version compatible with the computer you are using.

Apache Friends Download Add-ons Hosting Community About Search... Search EN

Download

XAMPP is an easy to install Apache distribution containing MariaDB, PHP, and Perl. Just download and start the installer. It's that easy.

XAMPP for Windows 7.3.26, 7.4.14 & 8.0.1

Version	Checksum	Size
7.3.26 / PHP 7.3.26 What's Included?	md5 sha1 Download (64 bit)	155 Mb
7.4.14 / PHP 7.4.14 What's Included?	md5 sha1 Download (64 bit)	156 Mb
8.0.1 / PHP 8.0.1 What's Included?	md5 sha1 Download (64 bit)	157 Mb

Requirements Add-ons More Downloads »

Windows XP or 2003 are not supported. You can download a compatible version of XAMPP for these

Documentation/FAQs

There is no real manual or handbook for XAMPP. We wrote the documentation in the form of FAQs. Have a burning question that's not answered here? Try the Forums or Stack Overflow.

- Linux FAQs
- Windows FAQs
- OS X FAQs
- OS X XAMPP-VM FAQs

Add-ons

Figure 9: Xampp download panel.

5.2.1.2 Xampp Control panel

After the installation process is complete, click on the newly downloaded Xampp icon and a Xampp control panel will pop up on the screen. Click on start for apache to activate the servers as well as start on Mysql for the database they will appear green. Click on admin on the Mysql to redirect to the browser of choice to open the database on the browser.

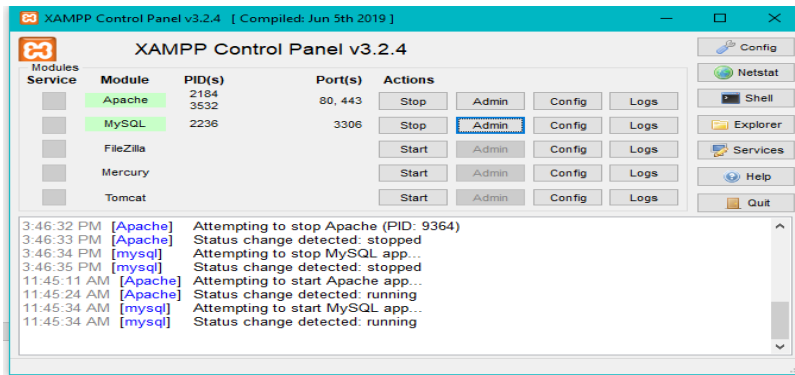


Figure 10 :Xampp control panel

5.2.1.3 Xampp folder

Open the Xampp folder, within the folder there is a folder called htdocs where the system files will be run from.

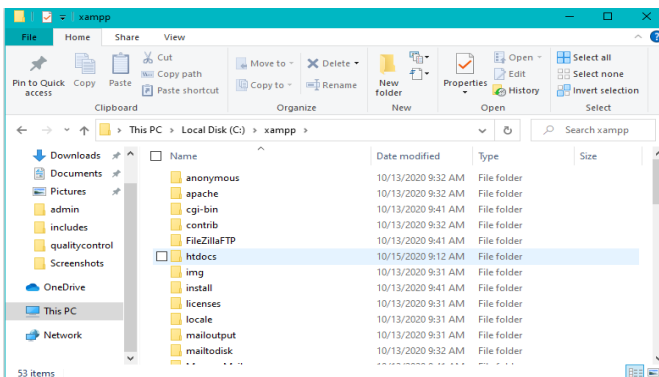


Figure 11: htdocs folder

5.2.1.4 Running Localhost.

With the Xampp server and database running open browser of choice and type on the URL bar localhost/name of the folder (qualitycontrol)/ specific file to open.

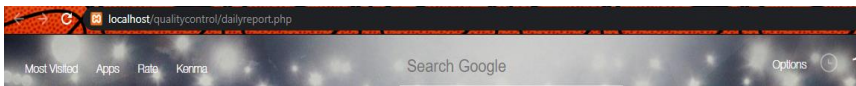


Figure 12: URL search bar for localhost

5.2.2 System manual

5.2.2.1 login Module

Users already with an account can login into the system by providing their email and password that they had signed up with.

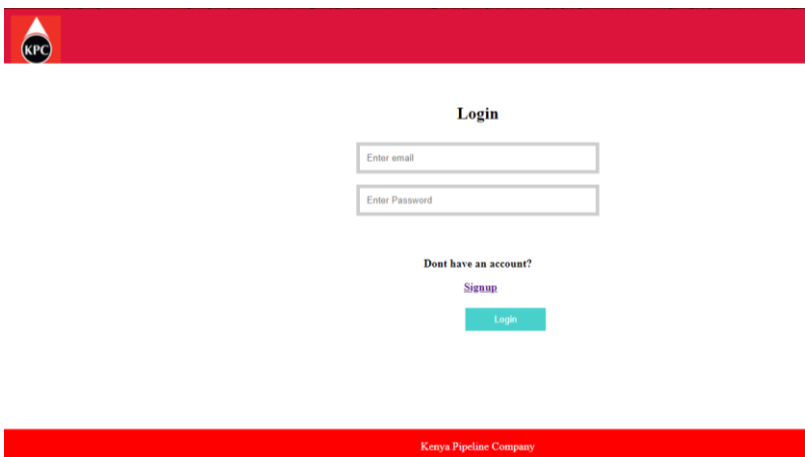


Figure 13:Login module

5.2.2.2 Signup Module

First time users click on the signup link in the login module to register themselves.



The screenshot shows a red header bar with the KPC logo on the left and the text "SignUp" in the center. Below the header, there is a form with five input fields, each outlined in red. The fields are labeled: "Employee Id (Numeric values only)", "First Name", "Last Name", "Email", and "Enter Password". Below the input fields is a "Signup" button. At the bottom of the page, there is a red footer bar with the text "Kenya Pipeline Company" in the center.

Figure 14:signup module

5.2.2.3 Home page module

There are two links on this module: product and report.



The screenshot shows a red header bar with the KPC logo on the left, the text "HOME" in the center, and two links, "Product" and "Report", on the right. The links are in a smaller font size and are positioned to the right of the "HOME" text.

Figure 15: Home module

5.2.2.4 Product module

The module where the different petroleum products data is collected for the current day by the technicians.

The screenshot shows a web application interface for 'PRODUCT DETAILS'. At the top left is the KPC logo. The title 'PRODUCT DETAILS' is centered. On the top right, there are links for 'Diesel', 'MSP', and 'Home'. Below the header, there are two dropdown menus: 'Select Product' with 'Diesel' selected, and 'Select Station' with 'Piz25' selected. The main form area contains several input fields: 'Batch No.' (with a date placeholder 'mm/dd/yyyy'), 'Tank No.' (with a placeholder '---'), 'Lab No.', 'Quantity Of Batch', 'Quantity Received', and 'Certificate Number'. A 'Submit' button is located at the bottom of the form. The footer of the page reads 'Kenya Pipeline Company'.

Figure 16: Product module

5.2.2.5 Diesel module (Two samples)

This is the module where two sample diesel mathematical quality check is performed. The technician will need to provide the room temperature and the diesel temperature. The operations will be computed automatically once provided with required data.

DIESEL DETAILS

Home 3 Samples MSP

TWO SAMPLES

TEMPERATURE

Sample Size: 2

Room Temperature:

Temp Read:

Final Temperature:

AVERAGE

Lower Value:

Upper Value:

AVERAGE:

STANDARDIZE

Select Range: 0.6480-0.6602

Final Reading:

Continue

Figure 17: Two sample diesel module

5.2.2.6 Diesel module (Three samples)

This is the module where three sample diesel mathematical quality check is performed. The technician will need to provide the room temperature and the diesel temperature. The operations will be computed automatically once provided with required data.

KPC DIESEL DETAILS Home Ik MSP

THREE SAMPLES

TEMPERATURE
Sample Size:

Room Temperature:

Temp Read:

Final Temperature:

AVERAGE

Lower Value:

Middle Value:

Upper Value:

AVERAGE:

STANDARDIZE

Select Range:

Final Reading:

Figure 18: Three sample diesel module

5.2.2.7 Msp module

Msp details are filled in step by step and at the final stage the user is prompted to save the record.

KPC MSP Product Report Home

1 of 4

% Volume recovered

10%:

20%:

30%:

40%:

50%:

60%:

70%:

80%:

90%:

95%:

Figure 19: MSP module

5.2.2.8 Report module

The daily shift report module is filled in step by step it captures the details of the petroleum products as well as the people on shift.

1 of 9

Select Date :

Figure 20: Shift report module

5.3 System testing

Test ID	Related requirement	Inspection check	Pre-condition	Test data	Priority level
T1	FR1	Does system allow users to log in?	Users already had signed up	ID: 340839 First Name: Omollo Last Name: Osodo	Medium

				Email: omollo.osodo@gmail.com Password: *****	
T2	FR2	Does system allow users to sign up?	Only technician staff should be able to sign up	ID: 606070 First Name: kemba Last Name: Walker Email: kemba.walker@gmail.com Password: *****	Medium
T3	FR3	Does system perform correct calculations	Quality technicians know how to perform the calculations	Room Temp: 20 Temp Read: 26 Final Temp: 6 Lower value: 13 Middle value: 13 Upper value: 13 Average: 13 Range: 0.6480-0.6602 Final reading: 0.16224	High
T4	FR4	Does system allow for deleting of records	There is a delete link for deleting	Wiseman record	High
T5	FR5	Does system allow for updating of records	There is an update link for updating	Kemba record	High

Table 3: System testing

Chapter 6: Conclusions, Recommendations and Future Works

6.1 Introduction

This chapter not only provides a summary of the above chapters, but also seeks to provide more insight on the additions that can be implemented to ensure efficiency. The additions mentioned will be covered in the sub-topics future works and recommendations.

6.2 Conclusions

The importance of accuracy cannot be necessitated enough in the development of a system that deals with converted data of different petroleum products: Illuminating Kerosene (IK), Motor Spirit Premium (MSP) and diesel. Calculations are automated to ensure that there is minimal human errors such as transcription errors and transposition errors. These human errors can result to serious consequences such as huge losses for the Oil Marketing Companies (OMC) and fatality since we are dealing with petroleum products.

Documentation: reports generated are also crucial for accountability purposes. The data captured, therefore, should be accurate to achieve this the systems has various validation criteria to ensure data captured is accurate.

6.3 Recommendations

An email module integrated into the different reports module would be necessary for the ease of spreading information around the organization as well as a digital scanning and signing feature to save on time.

6.4 Future works

The scope of this project was limited to only ensure that the calculations are automated to prevent human errors and to capture accurate data through validation of records to generate reports. The additions that can be added by future developers would be implementing a module for scanning with an extra feature of digital signatures for the signing of documents where needed by the relevant signatory.

Another model that can be added is the scheduling of shifts of the lab technicians for those who work during the day shift and night shift. The extra feature would be sending of text messages as well as an email that will inquire whether they are comfortable with the allocation of the shifts.

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Appendix A: Time schedule

	TASK TITLE	START DATE	DUE DATE	DURATION	PHASE ONE														
					WEEK 1				WEEK 2				WEEK 3				WE		
					M	T	W	R	F	M	T	W	R	F	M	T	W	R	F
5	Project progression																		
6	problem identification	4/15/20	4/21/20	6															
7	writing of concept note	4/22/20	4/28/20	6															
8	Chapter 1	4/29/20	5/5/20	6															
9	Chapter 2	4/29/20	5/5/20	6															
10	Chapter 3	5/20/20	5/26/20	6															
11	Abstract Writing	5/27/20	6/3/20	6															

Figure 21: Time schedule