



# Final Year Project – Report

## DEVELOPMENT OF ERP SOFTWARE SOLUTION FOR LOGISTICS MANAGEMENT OF MAPLE LEAF CEMENT



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## **ABSTRACT**

This project revolves around development and implementation of a software-based solution for logistics management at Maple Leaf Cement Factory. MLC 's vast and complex network for coal distribution had made their scheduling and tracking of coal very difficult, which results in loss of company's assets. The development of software is based in 3 phases.

The first phase is the designing of the software. This was done in collaboration with the Maple Leaf Cement representative Sir Saad Ahmed. It was largely done on pen and paper and ADOBE PHOTOSHOP was used to mock up some pictures of the website

The second phase is the development of software. PHP, MYSQL(MariaDB), HTML-5 and JAVASCRIPT were used for development of software

The third and last phase is debugging and proof check for bugs. The software was tested against data provided by MLC. We managed to list down possible user error and input false data and re-entries and debugged our software accordingly.

This report elaborates on how we successfully completed all these three phases and developed the software for MLC.

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## 1. INTRODUCTION

### 1.1. Introduction to The Industry

Maple Leaf Cement is the largest cement manufacturers in Pakistan. It was established in the year 1956 under the collaboration of West Pakistan Industrial Development Corporation (WPIDC) and the government of Canada (1). Later on, it was merged with White Cement Industries Limited (WCIL) forming the State Cement Corporation of Pakistan (SCCP). Today as a result of privatization in the cement industry the three companies have amalgamated to form Maple Leaf Cement Private Limited.

Maple Leaf Cement currently has two production lines dedicated to the production of grey and white cement. The manufacturing plant of the company is located at Daud Khel, Punjab near to the Salt Range and it covers an area of about 3,000 acres. To make sure for any interruption of supply for white and grey cement Male Leaf Cement has strategically built separate production plants for Grey and White Cement in this area.



Figure 1: Maple Leaf Cement Limited Product (1)

#### 1.1.1. Contribution to National Economy

Maple Leaf Cement is manufacturing the two of the very common products i.e. grey cement and white cement in a noticeably massive quantity. And it owns 90 percent of the market share of white cement and about 7 percent of the market when it comes to grey cement. The company is in the list of those few contributors who are exporting the product in bulks that are significantly helping the national economy of the country. Maple leaf cement is exporting to India, Afghanistan, the Middle East, and some other African countries.

### 1.2. Problem Description

Maple Leaf Cement has an extensive distribution network of coal. It has been ranked number one producer of cement for years. The production plant of the company is situated at the Daud Khel, Punjab. It uses coal as an energy source for power generation of the entire facility and in cement production, which is shipped-in in the country at Port Muhammad Bin Qasim. It strived to maintain a good quality standard and continuously improve the quality requirements.

But due to the vast number of parameters including government decision; such as the limitation on cargo amount with respect to axle load, and shifting order to Port Muhammad Bin Qasim from Kemari port. The complexity has increased and the company is facing more challenges as Port Qasim is relatively farther away from the railway station than Kemari and now they have to use increased number of the third parties of contractors for transportation of coal.

It has become harder to manage the requirement and distribution of coal on such a vast scale without any intelligent software. This lack of resources is leading to the following problems.

- i. When the coal is unloaded at Port Muhammad Bin Qasim the duty starts to be exercised. Due to the unavailability of schedule, and policy of port authorities on restriction over the amount of cargo that be extracted, the industry has to pay a huge amount of duty.
- ii. The transportation of coal is also carried out by railway carriages, which is a cheaper option, that can be used to reduce the cumulative amount of duty but cannot be utilized extensively as they do not follow a strict schedule.
- iii. The other option of transportation of coal is via trucks, but it has become more costly since decisions of government mentioned above.
- iv. During Transportation, the management loses the track of coal which has led to frequent deliveries to the wrong addresses and theft of cargo.
- v. Due to the lack of proper means of tracking, the company is notified about the wrong deliveries very late.
- vi. No proper means of tracking of each batch. The difficulty level increases as the number of trucks/carriages in each batch vary non-uniformly.
- vii. Due to the lack of resources for automated report generation, the company has to assign it to a worker. And as the human resource is already limited, and documentation is complex the generated report is neither productive nor efficient.
- viii. There is no proper documentation present to keep the record of coal and trace it backward.
- ix. There is no record of data which can be used for forecasting to make concrete and strategic future decisions.

### **1.3. Aim & Scope of Project**

The aim of this project is to develop an Enterprise Resource Planning software for Maple Leaf Cement Factory Limited. This software will specialize in the needs of the company. Specifically, it will contain the following modules.

- i. Inventory Management of raw material
- ii. Business intelligence module for incoming and outgoing raw material.
- iii. Scheduling of coal transportation considering all possible parameters.
- iv. Three pathways tracking of raw material.
- v. Financial management of raw material.
- vi. Monthly/Weekly report generation of required data
- vii. Feedback oriented software

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

Note: The project will not cover the solutions for **variability in railway schedule, real-time tracking of trucks and railway carriages, theft and complete mitigation of wrong deliveries.**

In Figure 2, the aims and scopes of this project are depicted



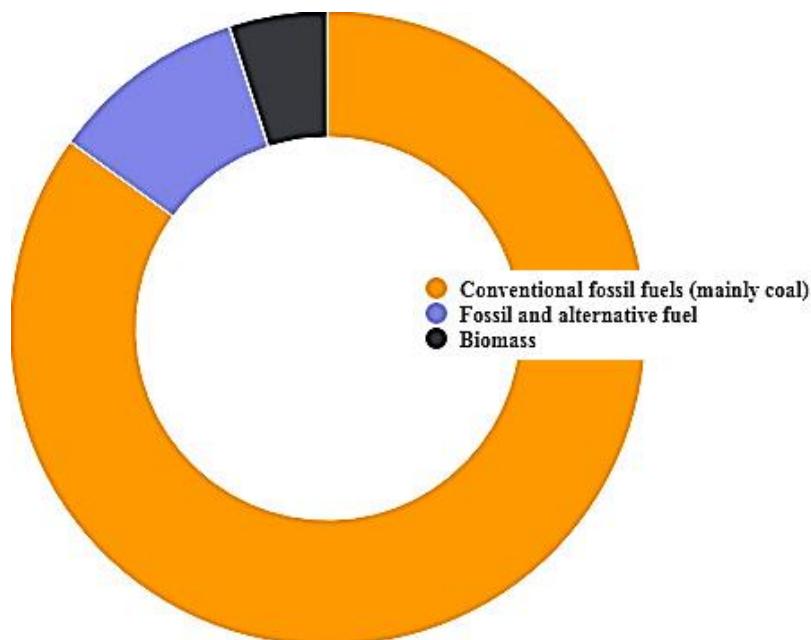
*Figure 2: Aims and Scope of the Project*

## 2. THE LOGISTICS PROCESS

After understanding the underlying problem and defining the solution to cater them, we can move towards understanding the complete logistics process in depth.

Maple leaf Cement Factory limited has an extensive network of coal transportation. It procures around 80,000-ton coal each month from South Africa for the manufacturing of cement and power generation of the whole plant. A large amount of energy that is required for the production of cement comes from coal. At the plant, it takes 200 – 450kg of coal to produce only one ton of cement.

The general fuel consumption in the manufacturing of cement is depicted in Figure 3:



*Figure 3: General Fuel Consumption in Cement Production (2)*

The logistics process of Maple leaf cement starts with the shipping of coal in the country. The coal is shipped-in at Port Muhammad Bin Qasim, each month. After shipping-in MLC can extract a certain amount of coal after paying duty each day against an index.

After MLC pays the duty, the truck (3<sup>rd</sup> party contractors) transport the coal to either one of the two locations.

- I. Directly to Plant (final destination)
- II. To the warehouse.

Sometimes, when trucks are unavailable and/or due to other reasons, MLC is unable to pick the coal from port, they lend it to another company. Which they received back later on.

Now, the coal present at warehouse needs to be transported to plant as well. This transportation is carried out by two method

- I. Via Trucks
- II. Via Railway Carriages

The summarized schematics of logistics process is given in Figure 4:

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

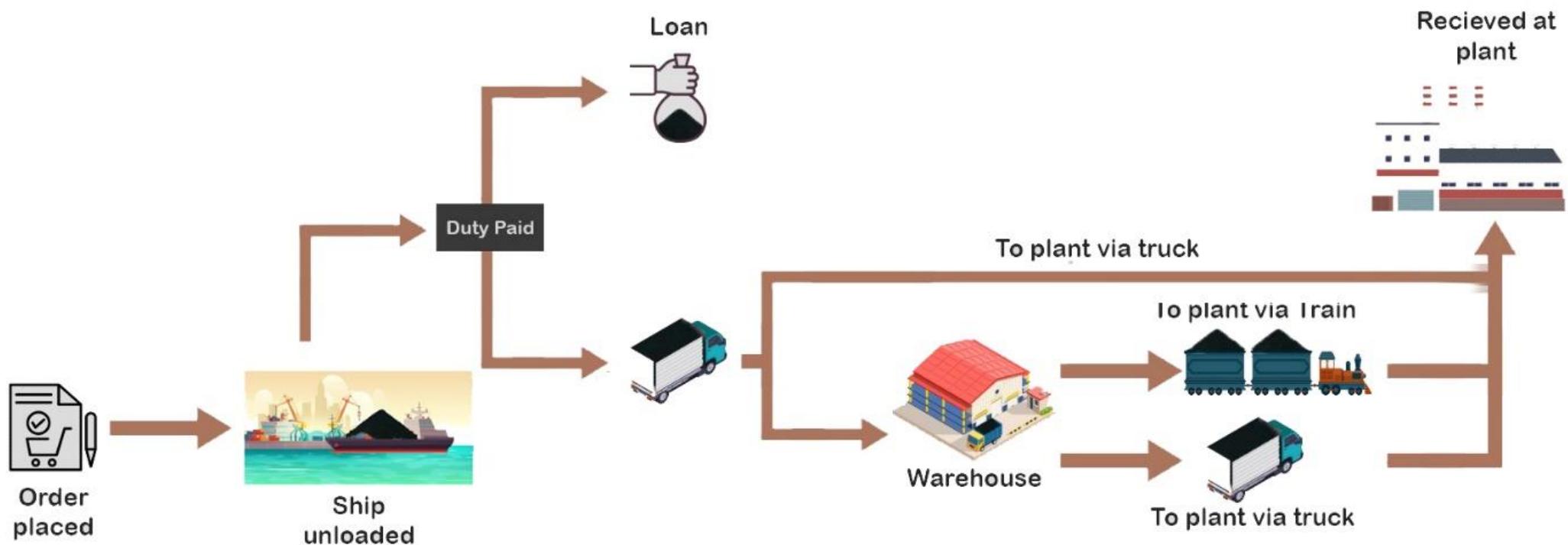


Figure 4: Schematics of Logistics Process of Maple Leaf Cement

### 3. LITERATURE REVIEW

Considering the problem, we studied various research journals on the implementation of Enterprise Resource Planning in various companies the most relevant ones were selected.

#### 3.1. Linking Case Studies to concept Generation

Researching case studies is an efficient tool one is required to do so, because of its relevance. As the project moves forward, we had to consider what is the basis for our ideas? Has it been done before? And if it has what did the previous research attempts bore fruit.

A case study is relevant, the more your research questions seek to explain some present circumstances. The concepts of case study research are to define the logic behind the selected process and the criteria required for your findings. Various concepts have been used to even out the various directions of the project and several case studies have been researched to ensure maximum insight into the problem at hand.

One cannot generalize from a single case; therefore, a single case study cannot contribute to scientific development. For this project, the concepts proposed down below were selected on the basis of the following case studies:

- i. Estimating the Impact of ERP Systems on Logistics System by Petri Helo and Bulcsu Szekely, University of Vaasa, Industrial Management, Vassa Finland
- ii. Analysis of various Software Process Models by Ashwin Mujumdar, Gayatri Masiwal, and P.M. Chawan, Department of Computer sciences, VJTI, Mumbai.

#### 3.2. Enterprise Resource Planning

Enterprise resource planning (ERP) is a business tool where the output of one module is input to another and the whole organization work under this synchronization making it an effective tool for better:

- i. On-time scheduling
- ii. Better Communication
- iii. Inventory management
- iv. Tracking of data
- v. Better data analysis for future decisions.
- vi. Easy to adopt

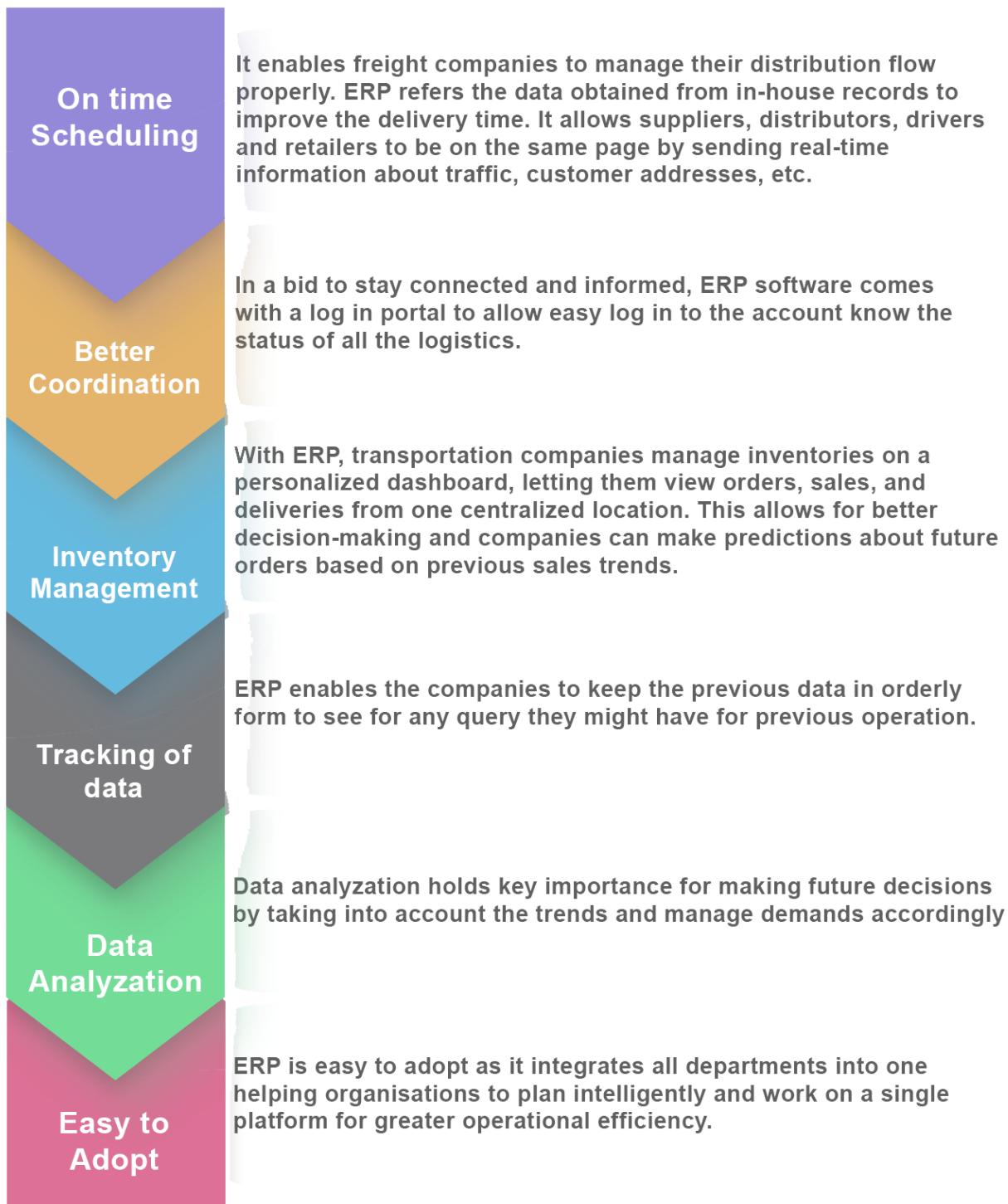


**Figure 5: Benefits of Enterprise Resource Planning**

In this era of the industrial revolution, companies are striving to maximize their current efficiency by spending minimum resources and gaining maximum output. Logistic department of any company plays a key role in production scheduling and on-time delivery of the product, MLC logistics department contains some gaps in operations which can be prevented by better planning and better allocation of resources, thus improving the efficiency of MLC logistics and saving a significant amount in terms of revenue of MLC.

### **3.2.1. Benefits of ERP:**

The implementation of enterprise resource planning can benefit a company significantly, some benefits are mentioned here,



**Figure 6: Benefits of ERP for MLC**

### 3.3. Software Development

The research journals indicated that any software that needs to be build have to go through a software development life cycle. In software development life cycle the developer decide the software development life cycle model they will be using.

So, first we have to decide the software development life cycle model we will be using and after choosing the development model we need to figure out the type of software we will be developing.

There are three types of software

- I. Client – Server Model
- II. Peer – to – Peer Model
- III. Desktop Application

The process of decision making regarding these two aspects is depicted in Figure 7:



Figure 7: Decision Schematics of SDLC and Type of Software

### 3.4. Software Development Life Cycle Model

Software development is the systematic approach of conceiving, designing, assessing, developing, testing and debugging of an application framework. There are several approaches to software developing project management called the software development life cycle. SDLC, a.k.a. model or methodology is a framework that structure, plan and control the process of development. It collectively involves all stages; programing, embodying and deploying.

A typical SDLC consist of 6 stages:

- i. Planning & Requirement analysis
- ii. Defining requirements
- iii. Designing the product architecture
- iv. Building the product
- v. Testing the product
- vi. Deployment and Maintenance

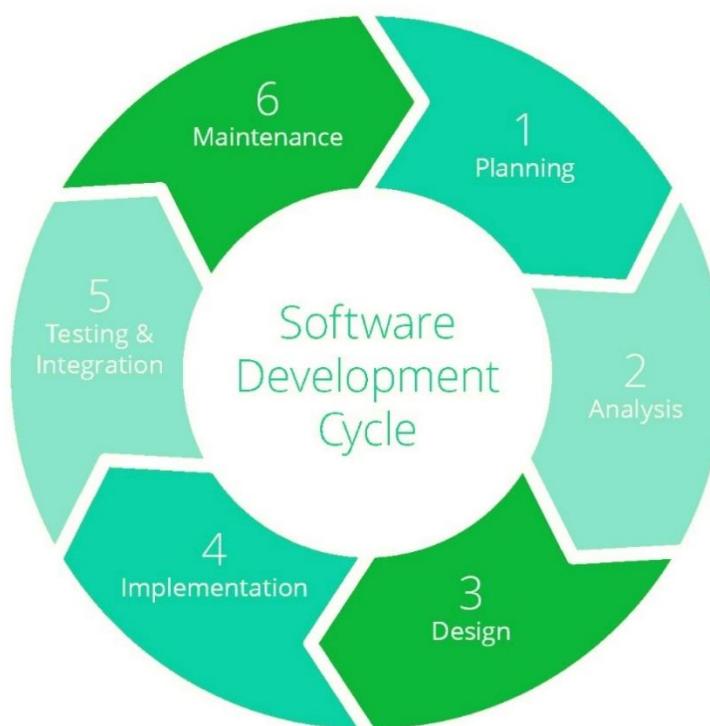


Figure 8: Software Development Life Cycle (3)

The SDLC have various approaches, called Software Development Process Models. Each model follows a unique set of steps to ensure success in software development.

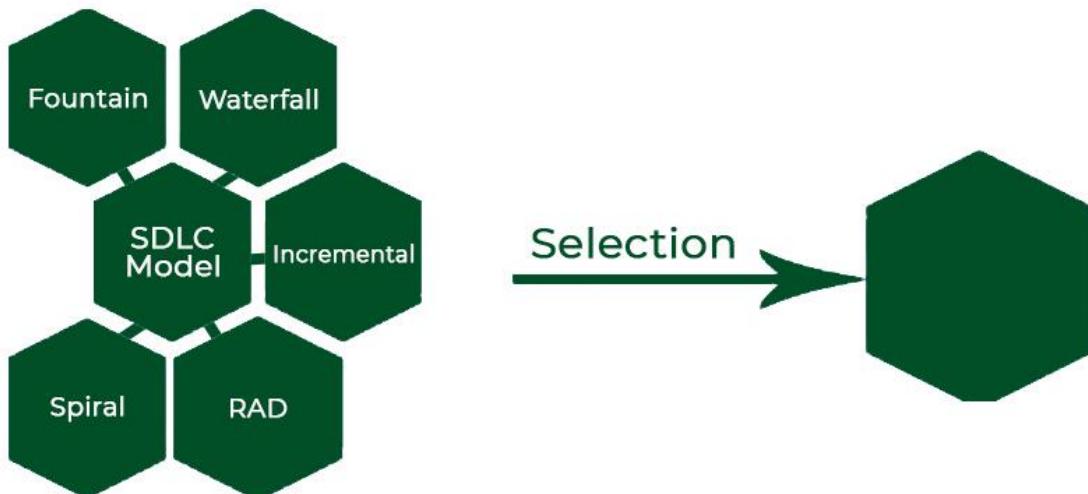
There are more than 20 SDLC models present currently and various models are under development.

We studied and deduced the names of the top 5 most popular models.

The top five most popular models of SDLC are as follows;

- i. Waterfall Model
- ii. Spiral Model
- iii. Incremental Model
- iv. Rapid Application Development Model
- v. Fountain Model

We need to study all five SDLC models and then decide which one is the most optimal approach.



**Figure 9: Decision Schematics for SDLC Model**

Let us now discuss the all five model in detail.

### **3.4.1. Waterfall Model**

The waterfall model is a traditional model. It has linear sequential characteristics where every phase is dependent on the completion of the previous phase. Each phase is executed in a manner that it cannot be repeated again. This rigidity leads to the demand that all system requirement must be defined at the beginning of the project, only then the design phase can begin.

The stages of waterfall model include;

#### **3.4.1.1. Define Requirement and Analyze**

The overall requirements of the software to be developed are defined in this stage. Also, all requirements are documented in the “specification” document.

#### **3.4.1.2. Design**

In the second phase of the waterfall model, all required specifications from the first phase are studied and the software architecture is created.

#### **3.4.1.3. Implementation**

In the third phase, the input is taken from the design phase and the software is broken into small programs called units. Each unit is tested separately for its functionality, this is known as unit testing.

#### **3.4.1.4. Integration and Testing**

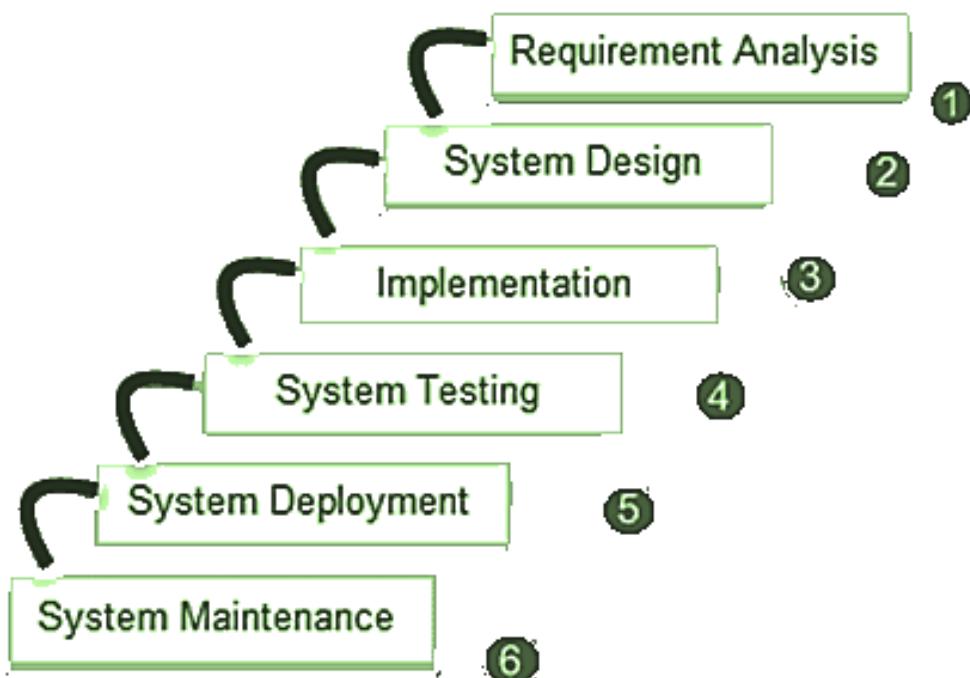
In the fourth stage, all units from the previous stage are integrated into a single software. This software now goes through overall testing to identify any faulty elements.

#### **3.4.1.5. Deployment of System**

After the functional testing takes place the software is deployed in the client's environment.

#### **3.4.1.6. Maintenance**

The last step occurs after the installation of the software. It involves the debugging and modifications to the software or its individual components to improve performance.



**Figure 10: Waterfall Model - SDLC (4)**

#### **3.4.2. Spiral Model**

The second SDLC model is Spiral Model. It is a risk-driven methodology of SDLC. It has four phases and each phase is represented by one of the quadrants. Every project passes through these phases in iterative mode, creating a spiral.

The four phases include;

##### **3.4.2.1. Identification**

The first phase of the spiral model starts with the gathering of business requirements in the baseline spiral, and as the project evolves, in the subsequent spiral the requirement of the system, subsystem and unit are identified.

##### **3.4.2.2. Design**

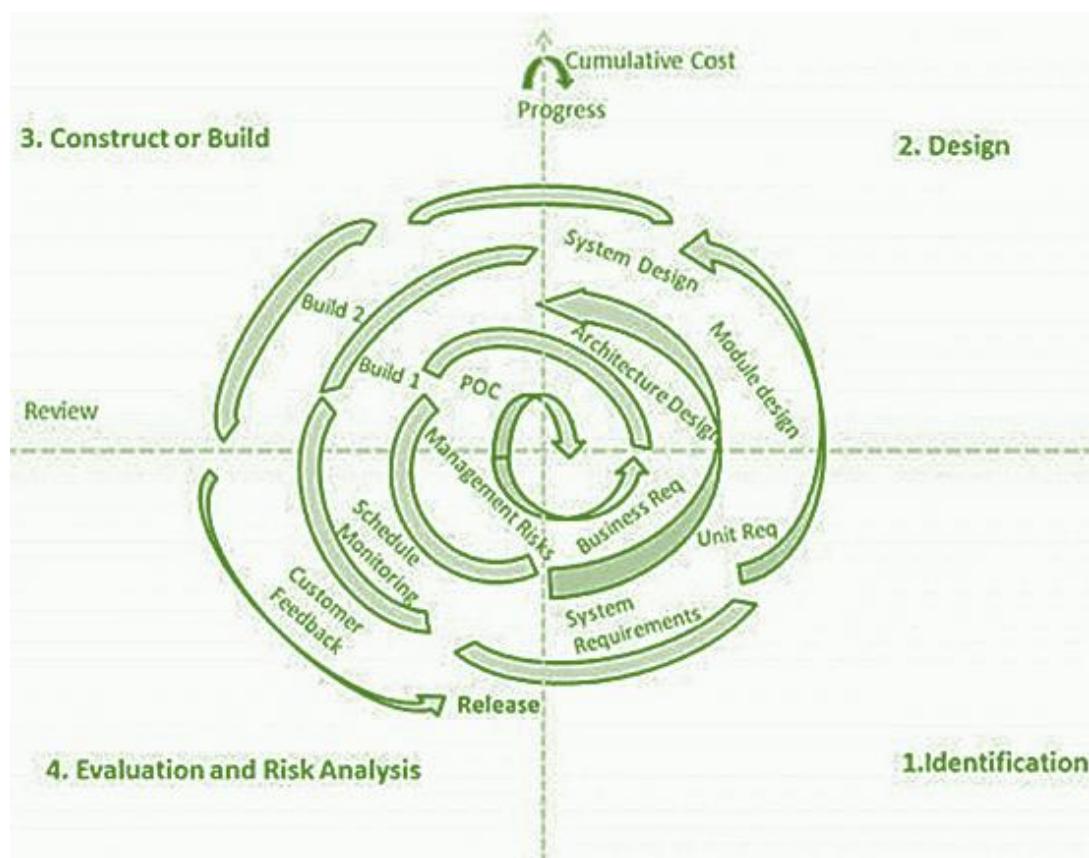
This phase starts with a conceptual design. This is done in the baseline spiral. In the subsequent spiral, the architectural design, module design, and final design are created.

### **3.4.2.3. Construct**

This phase refers to the programming of the actual software. In the baseline spiral, only proof of concept is developed to receive customer's feedback, whereas, in subsequent spirals, different versions of the working model are created with high clarity on design details and requirements.

### **3.4.2.4. Evaluate**

The last phase of the spiral model refers to the risk analysis and evaluation of the software. In this phase the all risks are identified, estimated, monitored and managed. After evaluation, the customer provides feedback.



**Figure 11: Spiral Model - SDLC (5)**

### **3.4.3. Rapid Application Development**

Third in list is Rapid Application Development (RAD) Model. It is a methodology that emphasizes rapid prototyping and iterative delivery. It is a sharp alternative to the waterfall model that falls under the category of agile development techniques. The very essence of this model is that it is inherently adaptable to iteration and experimentation. The four basic steps RAD follows are:

#### **3.4.3.1. Planning Requirement**

It is the initial stage of RAD methodology. During this stage, the client, designer, and developer come to a rough agreement on the scope of the project and software requirements.

#### **3.4.3.2. User Feedback**

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In this stage, the user feedback is gathered on software architecture. This leads to the creation of an initial model of software. This step is repeated according to the requirement as the project evolves.

### 3.4.3.3. Rapid Construction

Once the client agrees on the architecture of software its construction begins. In this phase the coding, testing, and integration take place. Along with user feedback, the rapid construction phase is repeated as necessary to meet the needs of the client.

### 3.4.3.4. Transition

The final stage of RAD allows the developers to produce the final version of the software and implement it to the live production environment with necessary full-scale testing and training of employees.

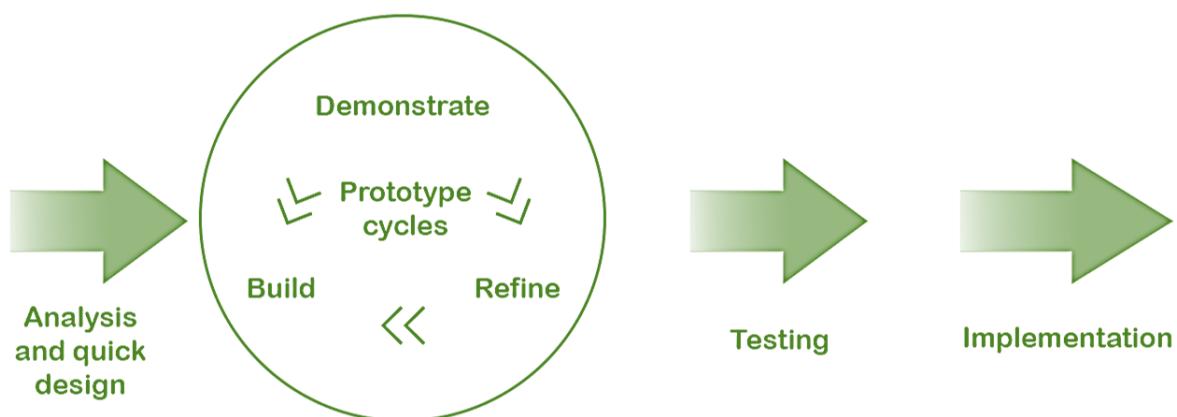


Figure 12: Rapid Application Development Model - SDLC (6)

### 3.4.4. Incremental Model

The incremental model is the non-monolithic methodology of SDLC where the complete software is designed, deployed and tested incrementally. This means a little is added each time until the development of the product is completed.

The complete software is broken down into several increments and the next increment in the software depends upon the data extracted from the previous increment. These increments can be developed using waterfall or RAD methodology.

In this model the testing and debugging are relatively easier and frequent; after each increment, due to which the faults in the software can be quickly identified.

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

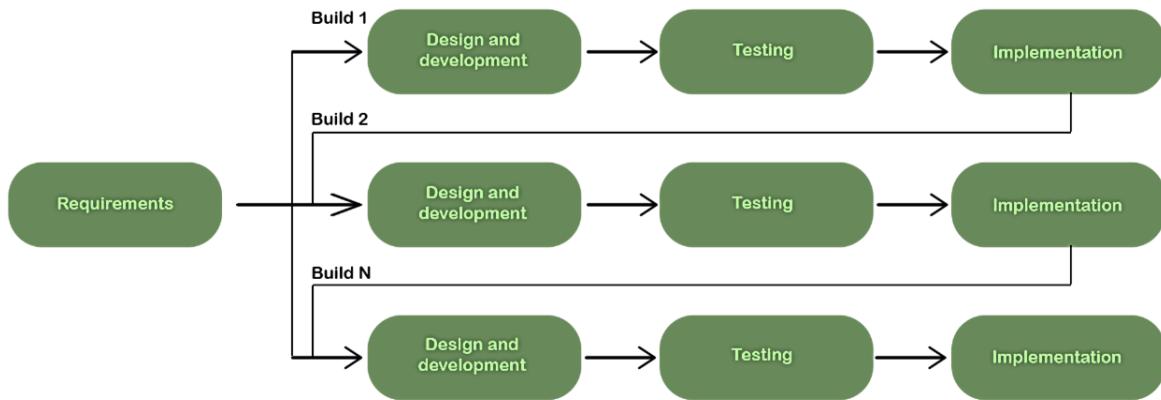


Figure 13: Incremental Model - SDLC (7)

### 3.4.5. Fountain Model

The fountain model is an object-driven methodology of SDLC. It is the logical improvement of the waterfall model. It follows the same steps as the waterfall methodology in the same sequence, however, this model allows the fallback to the previous phase.

Although there are some activities that depend upon the completion of another. But there is considerable overlapping of stages throughout the software development cycle.

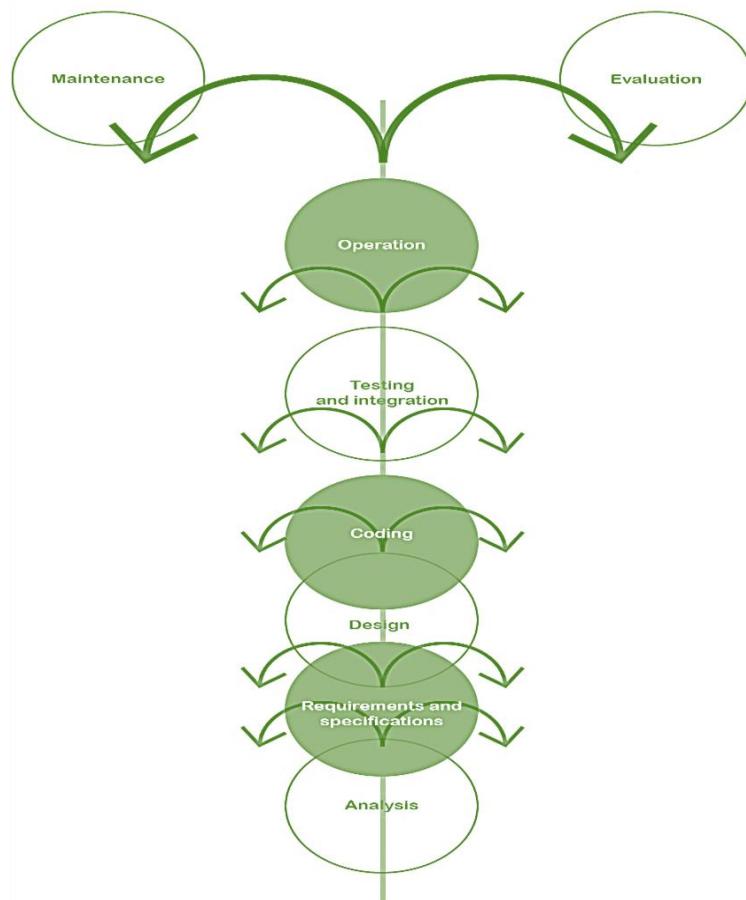


Figure 14: Fountain Model - SDLC (8)

After understanding all aspects of each software development life cycle model, we have to move on towards the selection of one of the models.

### **3.5. Concept Screening - SDLC Model**

The best possible SDLC models are selected by the concept screening process. Concept screening is the process of evaluating the number of possible options to figure out the best suited to the team's needs on the basis of certain criteria.

#### **3.5.1. Designation of Alphabets to SDLC Models**

The list of criteria for selection of SDLC Model are as follows:

*Table 1: Designation of Alphabets to SDLC Models*

A	Waterfall Model
B	Spiral Model
C	RAD
D	Incremental Model
E	Fountain Model

Now we have to set the criteria for selection and perform the concept screening process.

### **3.5.2. Concept Screening**

The concept screening was performed. Table 2 indicates the process.

**Table 2: Concept Screening for Selection of SDLC Model**

S.NO.	Criteria	A	B	C	D	E
1	Adaptable for Small scale project	0	-	-	-	+
2	Provide us with window to improve the already set requirements	-	+	+	+	+
3	Feedback of client present in each phase	-	+	+	+	0
4	Adaptable to improve in requirements	-	+	0	0	+
5	For object-oriented projects, allowing decomposition into modules	+	-	0	+	+
6	Room to improve error before implementation	-	+	-	-	+
	<b>Pluses</b>	1	4	2	3	5
	<b>Zeros</b>	1	0	2	1	1
	<b>Minus</b>	4	2	2	2	0
	<b>Net</b>	-3	2	0	1	5
	<b>Ranked</b>	5th	2nd	4th	3rd	1st
	<b>Continue?</b>	No	No	No	No	Yes

### **3.5.3. Conclusion**

From the concept screening process, it is clear that Fountain Model is best suited to this project

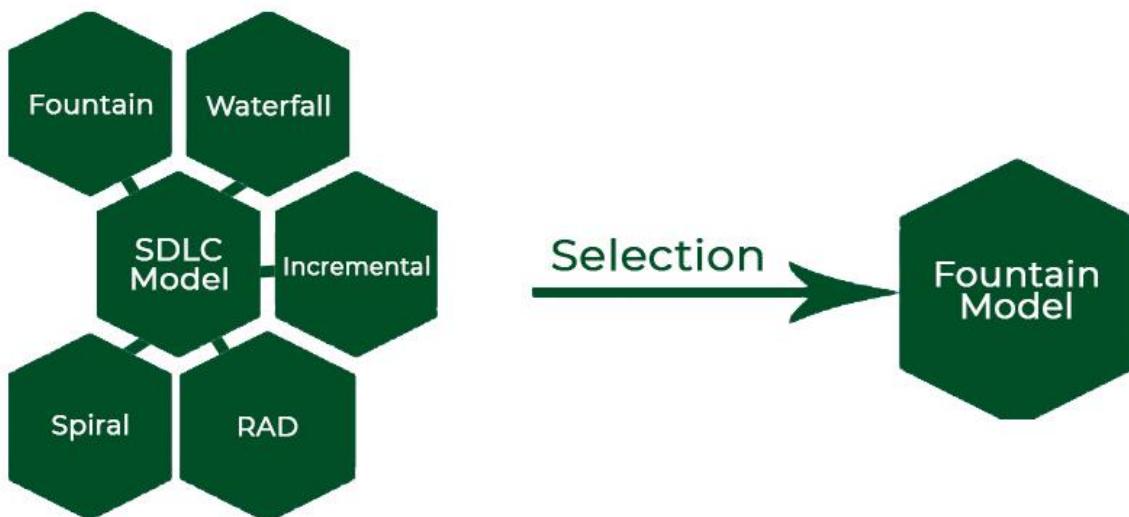


Figure 15: Decision for SDLC Model

The software development life cycle model has been selected, now in the next section, we will consider the number of possible types of software that can be created to solve the on-hand problem, use the concept selection tool to identify which type of software is optimal. And then we will be building the selected-type-of-software using Fountain Model Methodology.

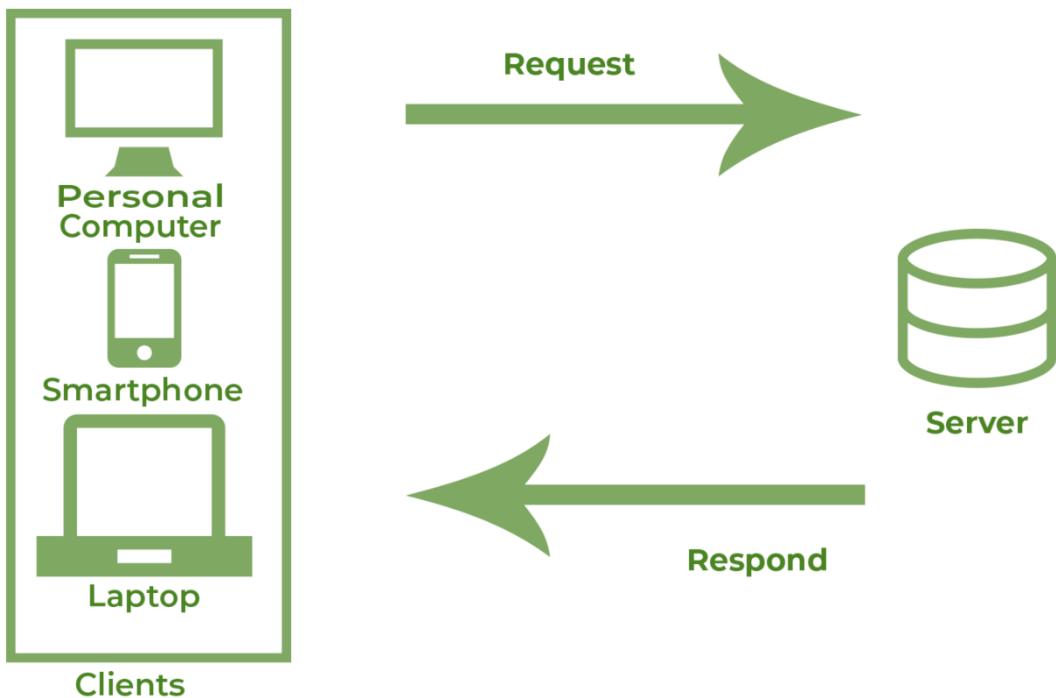
### 3.6. Type of Software

There are three available options that can be used to solve the on-hand problem of the development of ERP software solutions for logistics management.

- I. Client-Server model (Web Application)
- II. Peer – To – peer model
- III. Desktop application

#### 3.6.1. Client-Server Model

Client-server model a.k.a. the web application has a distributed application structure that works between the providers of services of information called servers and the service requesters known as clients. The client sends the request using any devices such as laptops, mobile phones, personal computers, etc. Whereas the server can reside on any high performing computer such as supercomputer. But with small – scale database, the same personal computer has the ability to behave like one. The working principle of Client-Server Model is shown in Figure 16:



**Figure 16: Client - Server Model**

There are four building blocks of Client-server model

- i. Database Management System
- ii. Graphic User Interface
- iii. Web Server
- iv. Integration Platform

#### **3.6.1.1. Database Management System**

Database Management System (DBMS) is the collection of programs that allows the user to create, update and delete their own database. DBMS organizes the data in the form of tables which makes it easier to retrieve specific information from a large amount of data in milliseconds. These tables are linked together according to the requirement in three possible patterns, which are one-to-one, one-to-many and many-to-many.

DBMS is the backbone of any ERP system; it is the platform where the integration of all databases occurs. ERP systems are usable with more than one database so that the customer can have variety. The database is creating using certain programming language.

The top ten DBMS language/applications are as follows:

- 3.6.1.1.1. Oracle Database**
- 3.6.1.1.2. MySQL**
- 3.6.1.1.3. MS SQL Server**
- 3.6.1.1.4. PostgreSQL**
- 3.6.1.1.5. MongoDB**
- 3.6.1.1.6. IBM DB2**

- 3.6.1.1.7. Microsoft Access
- 3.6.1.1.8. Teradata
- 3.6.1.1.9. SAP ASE
- 3.6.1.1.10. Cassandra



Figure 17: Programming Languages to Develop DBMS

In the Section 4, we will be selecting the best suited programming language for us.

### 3.6.1.2. Graphical User Interface

The second building block of Client – Server Model is Graphical User Interface (GUI). A Graphical User Interface (GUI) is a screen that appears in front of the user. It is an important part of the software as it enables the human-computer interaction.

There are several tools for creating GUI, including programming languages and GUI builder. The programming is an effective, maintainable and extendable approach. The top ten programming languages for front – end coding are as follows;

- 3.6.1.2.1. C#
- 3.6.1.2.2. C/C++
- 3.6.1.2.3. JavaScript
- 3.6.1.2.4. Objective C
- 3.6.1.2.5. Ruby
- 3.6.1.2.6. HTML & CSS
- 3.6.1.2.7. Swift
- 3.6.1.2.8. Java
- 3.6.1.2.9. Python
- 3.6.1.2.10. Perl



Figure 18: Programming Languages for Development of GUI

### 3.6.1.3. Web Server

The third building block of Client – Server Model is Web Server. A web server is a program where complete data such as text, images, video, and application data are stored. It serves the files from the web page to the requisitioned platform using Hyper Text Transfer Protocol (HTTP).

A web server can host single or multiple requests at the same time, depending on hardware resources and speed of access. There are numerous web server options available including the following,

- 3.6.1.3.1. Apache HTTP Server
- 3.6.1.3.2. NGINX
- 3.6.1.3.3. Apache Tomcat
- 3.6.1.3.4. Node.js
- 3.6.1.3.5. Tengine
- 3.6.1.3.6. Mongrel 2
- 3.6.1.3.7. Oracle iPlanet
- 3.6.1.3.8. Litespeed Server



Figure 19: Web Servers

#### 3.6.1.4. Integration Platform

The last and most important building block of Client – Server Model is Integration Platform. It is a web development framework intended to simplify the integration between the DBMS and GUI. It behaves as the controller between the model and view. When a user interacts with the software and sends a command (by clicking on a certain button) the integration platform sends the signals to DBMS indicating which query needs to perform an operation.

The working of Model View Controller is depicted in Figure 20:

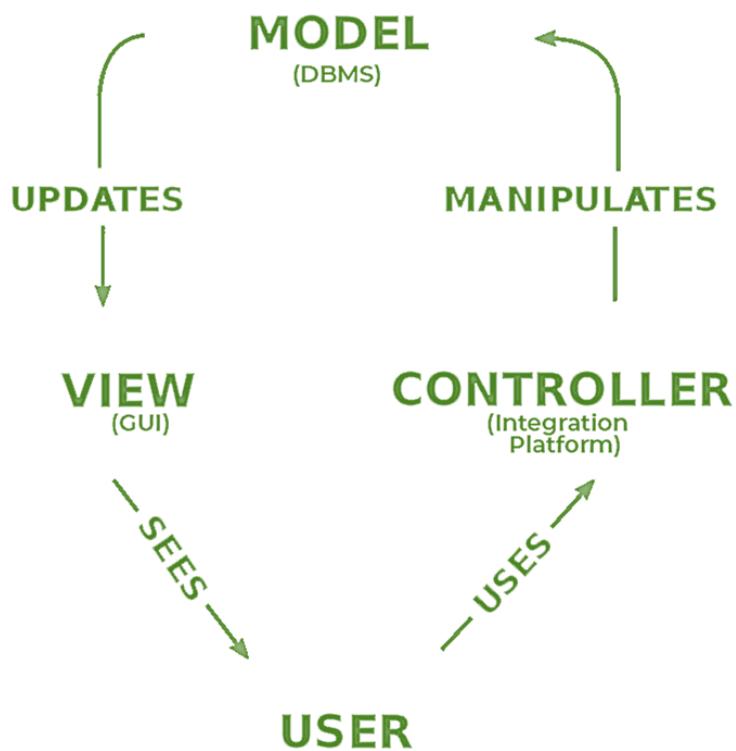


Figure 20: Model View Controller (9)

There are only a few options present in the selection of an integration platform. The top five options are mentioned below;

- 3.6.1.4.1. ASP .NET
- 3.6.1.4.2. JAVA Server Faces

- 3.6.1.4.3. MyBatis
- 3.6.1.4.4. Spark
- 3.6.1.4.5. Hibernate



Figure 21: Programming Languages for Integration Platform

### 3.7. Peer – To – Peer Model

The second type of software is Peer – To – Peer Model. It is a decentralized network of computers connected to each other via the internet. In contrast to the client-server model in P2P, the client at one time requesting a piece of information can become a server for another request. Each peer is both consumer and supplier of resources available on the specific network.

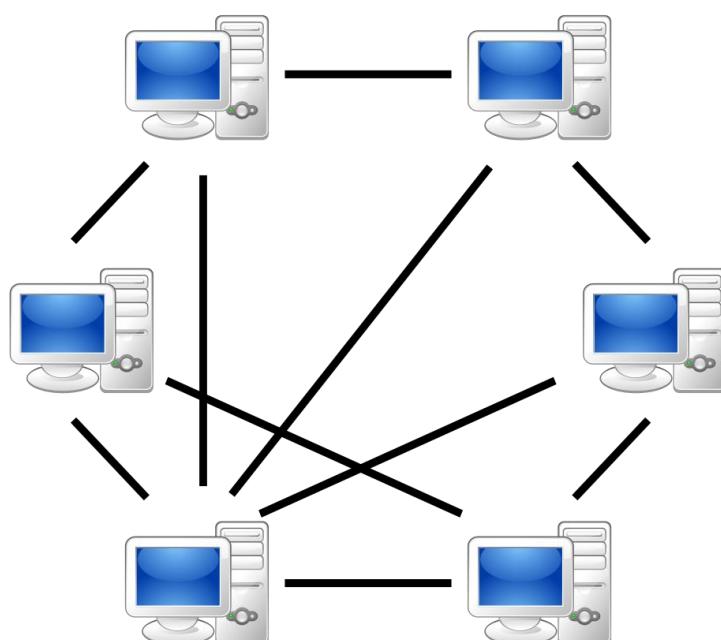
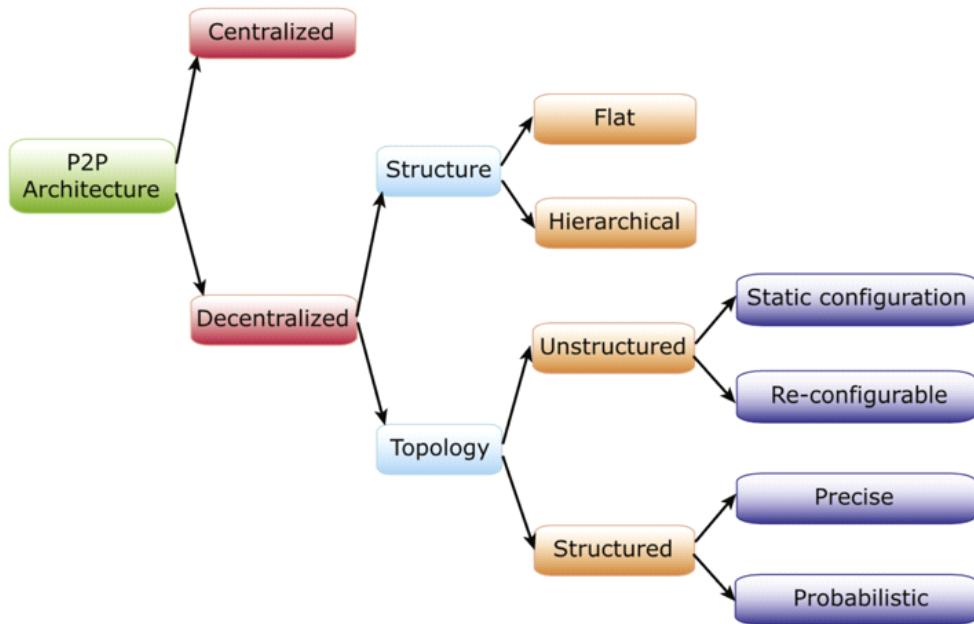


Figure 22: Peer - To - Peer Model (10)

In P2P, there is a sharing of processing power, disk storage, and network bandwidth that are available to all participating networks, without the necessity of a central server. Data is exchanged directly over the IP address in use and in the application, the layer peers are able to communicate via layer overlays links. Overlays are used for indexing and peer discovery. It also makes the peer to peer system independent from the physical network topology.

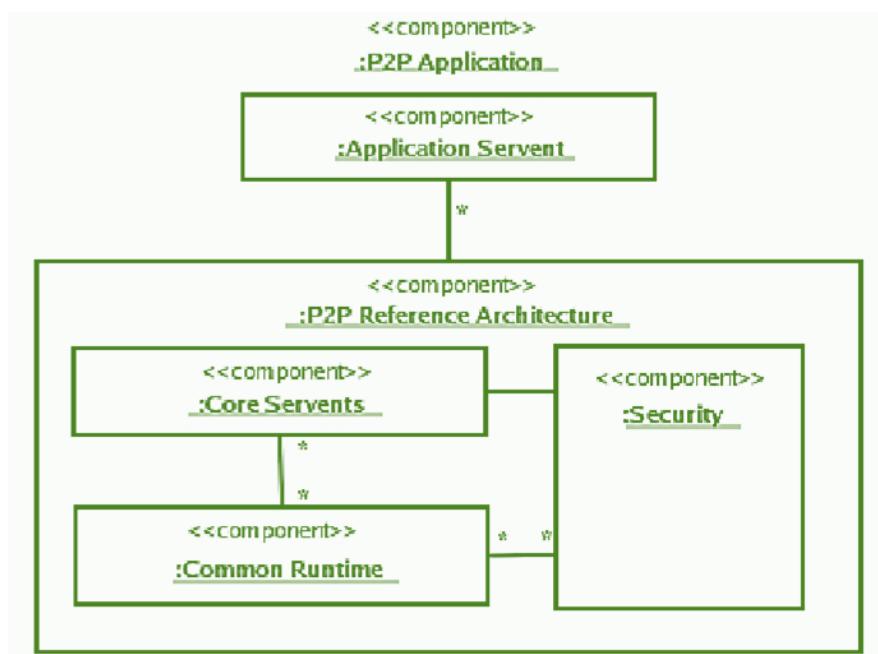


**Figure 23: Working Principle of Peer - To - Peer Model (11)**

### 3.7.1. Components of Peer – To – Peer Model

The building blocks of Peer – to – Peer model includes:

- i. Graphical User Interface (P2P application)
- ii. Application Server
- iii. Security Module
- iv. Run time



**Figure 24: Generic Architecture of Peer - To - Peer Model (12)**

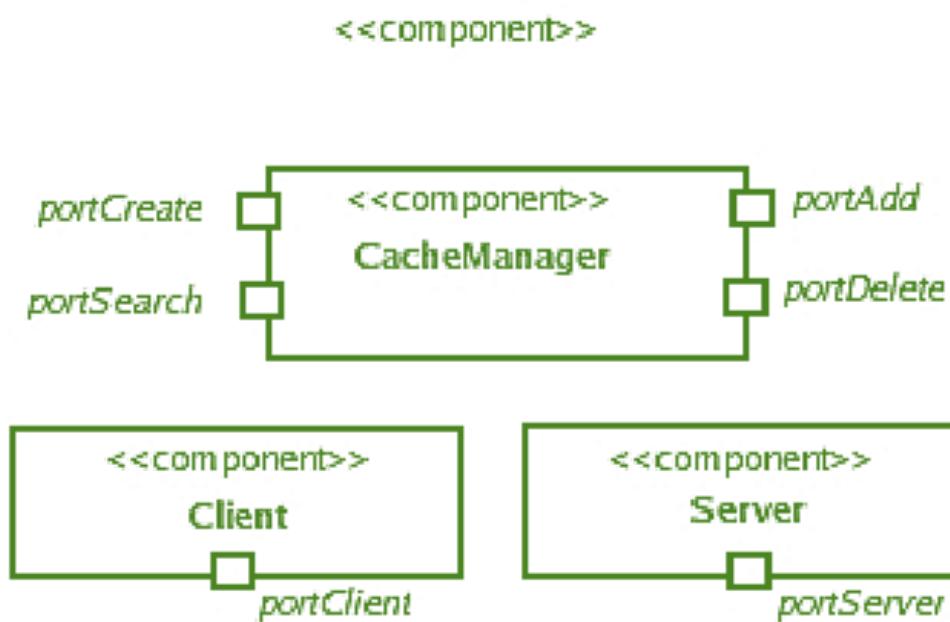


Figure 25: Peer - To - Peer Runtime Component (12)

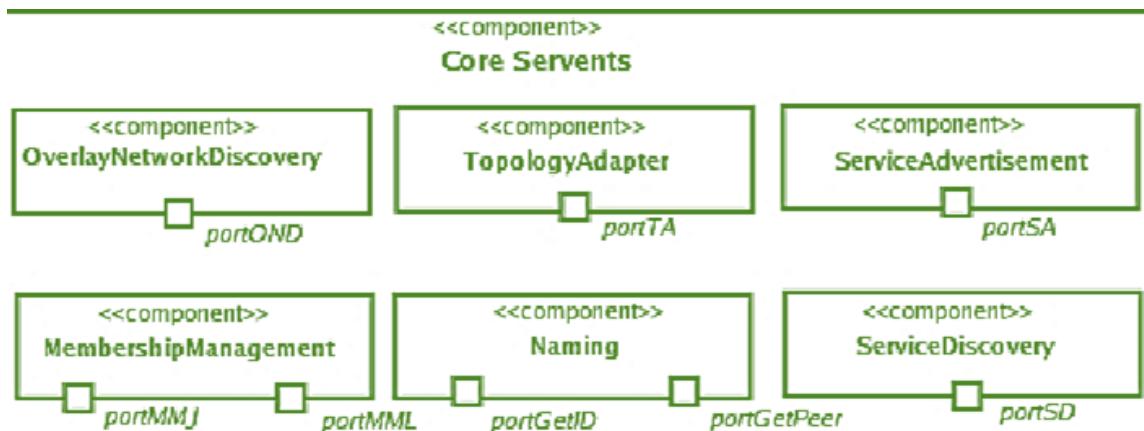


Figure 26: Peer - To - Peer Core Servant (12)

### 3.8. Desktop Application

The third option in type of software is the desktop application. It is a stand-alone application like MSWord, Google Chrome, Skype, etc. Unlike the Client-server model and peer – to – peer model it does not require an internet connection to run. The desktop application has a graphical user interface that is created by windows form. It provides various control options including but not limited to, Textbox, buttons, checkbox, radio button, etc.



**Figure 27: Desktop Application Development (13)**

### 3.8.1. Component of Desktop Application

The building blocks of desktop application includes

- i. Windows Form
- ii. Database Management System
- iii. File Hosting Service.

## 4. CONCEPT SELECTION

In this section we will be comparing all three types of software and using weighted matrix tool we will be decide the best type of software for on-hand problem.

### 4.1. Client-Server Model VS Peer – To – Peer Vs Desktop Application

The best type of software between the Client-Server model, Peer – to – Peer and Desktop application is evaluated using a weighted rating matrix as shown below:

The decision schematics is shown in Figure 28:

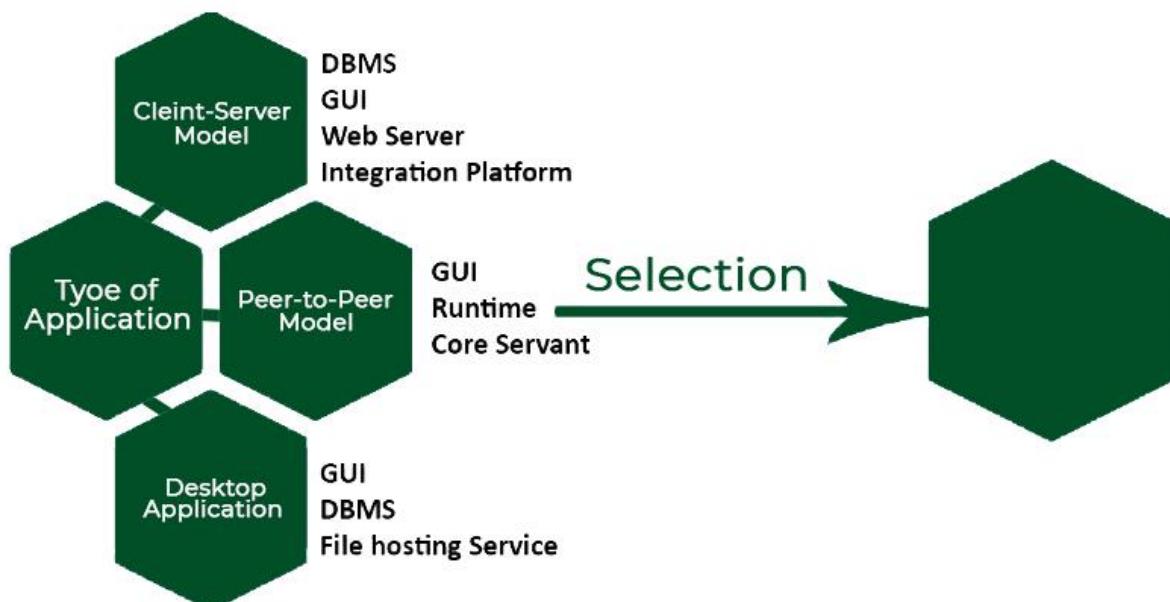


Figure 28: Decision Schematic for Selection of Type of Software

#### 4.1.1. Introduction to Weighted Rating Matrix

In the course of the project, there are several options available. These options can be selected on the bases of various factors. Each factor has its own importance. So, one has to consider and weigh out the importance of each factor as no option is perfect and there is no obvious winner.

Weighted rating is a method to aid one decide between different options based on criteria defined by the project team. Every criterion is assigned some degree of importance and then the overall score is calculated.

#### 4.1.2. List of Criteria

The criteria for concept evaluation are

*Table 3: List of Criteria for Selection of Type of Software*

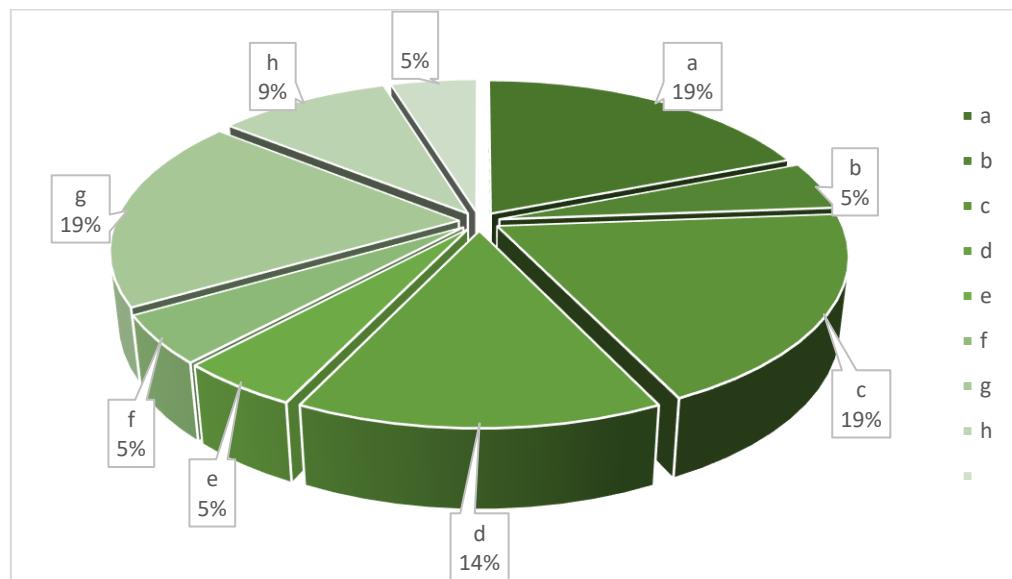
a	Difficulty Level (in terms of learning)
b	Security (of data for customer/industry)
c	Usability (Ease of Use)
d	Time Consumed (in learning & coding)
e	Cost (of implementation)
f	Prior knowledge
g	Ease of implementation
h	Expandable option for customer/industry

#### 4.1.3. Criteria Weighing

Each Criterion will be assigned a certain weight. The Table 4, indicate the process and result.

*Table 4: Criteria Weighing for Type of Software*

	a	b	c	d	e	f	g	h	i	Sum	Weight (%)
a	1	1	1	0	1	0	0	0	0	4	19.05
b	0	0	0	0	0	0	0	0	1	1	4.76
c	0	1		1	0	0	1	0	1	4	19.05
d	1	0	0		0	1	0	0	1	3	14.29
e	0	0	0	0		0	0	1	0	1	4.76
f	0	0	0	0	0		0	0	1	1	4.76
g	0	1	1	1	0	0		0	1	4	19.05
h	0	1	0	0	1	0	0		0	2	9.52
i	0	0	0	1	0	0	0	0		1	4.76



**Figure 29: Criteria Weightage - Type of Software**

#### **4.1.4. Weighted Rating Matrix**

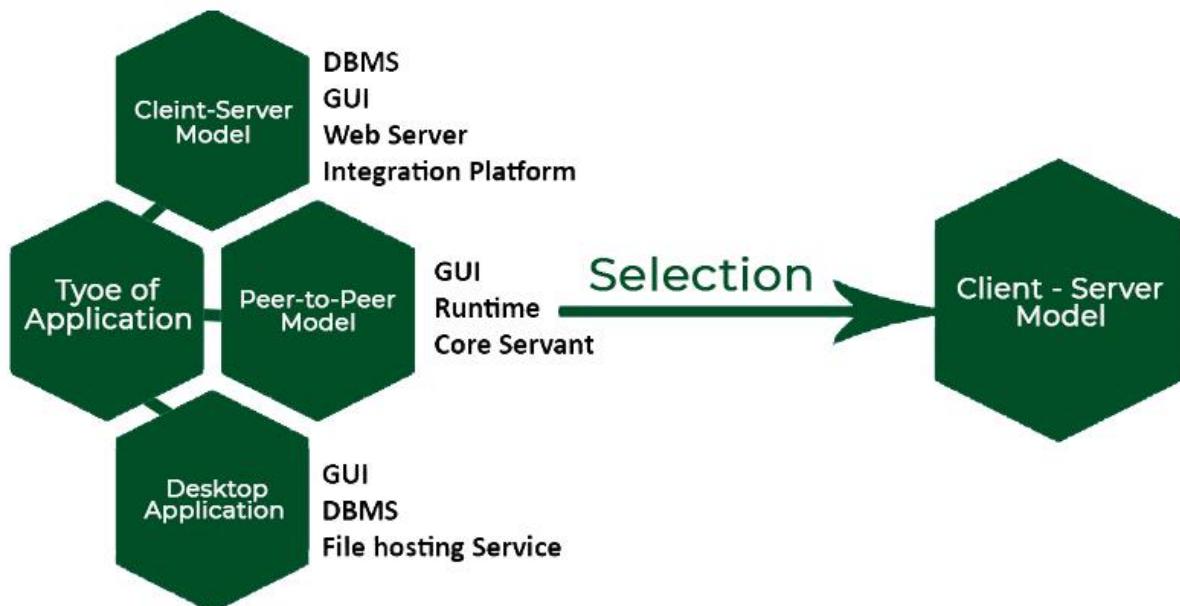
The type of software is determined using a weighted rating matrix, the calculation is as follows

**Table 5: Weighted Rating Matrix for Selection of Type of Software**

Criteria	a	b	c	d	e	f	g	h	i	TOTAL	RANKING	CONTINUE?
Weightage (%)	19.05	4.76	19.05	14.29	4.76	4.76	19.05	9.52	4.76	10.00		
<b>CLIENT-SERVE MODEL</b>												
Sore out of 10	4.00	8.00	9.00	7.00	7.00	8.00	7.00	9.00	9.00	7.19	1st	YES!
Weighted Score	0.76	0.38	1.71	1.00	0.33	0.38	1.33	0.86	0.43			
<b>PEER-TO-PEER MODEL</b>												
Sore out of 10	6	9	6	8	6	4	5	6	3	6.00	2nd	NO!
Weighted Score	1.14	0.43	1.14	1.14	0.29	0.19	0.95	0.57	0.14			
<b>WINDOWS APPLICATION</b>												
Sore out of 10	7	4	8	8	6	6	7	2	5	6.52	3rd	NO!
Weighted Score	1.33	0.19	1.52	1.14	0.29	0.29	1.33	0.19	0.24			

#### 4.1.5. Conclusion

From weighted rating analysis, it is cleared that the Client-Server Model is the best solution. The decision Schematics is shown in Figure 31:



*Figure 30: Decision Regarding Type of Software*

Now, that we have selected the Type of Software we will develop, we need to select the programming languages to create the building blocks of selected type of software.

#### 4.2. Selection of Languages/Software

The results of the weighted rating matrix clearly indicate the Client-Server Model is an appropriate choice to solve the on-hand problem. The client-server model has four building blocks as mentioned before [3.6.1]. Each building block can be programmed using various languages. We have to select the optimal language for each building block as depicted in Figure 31:

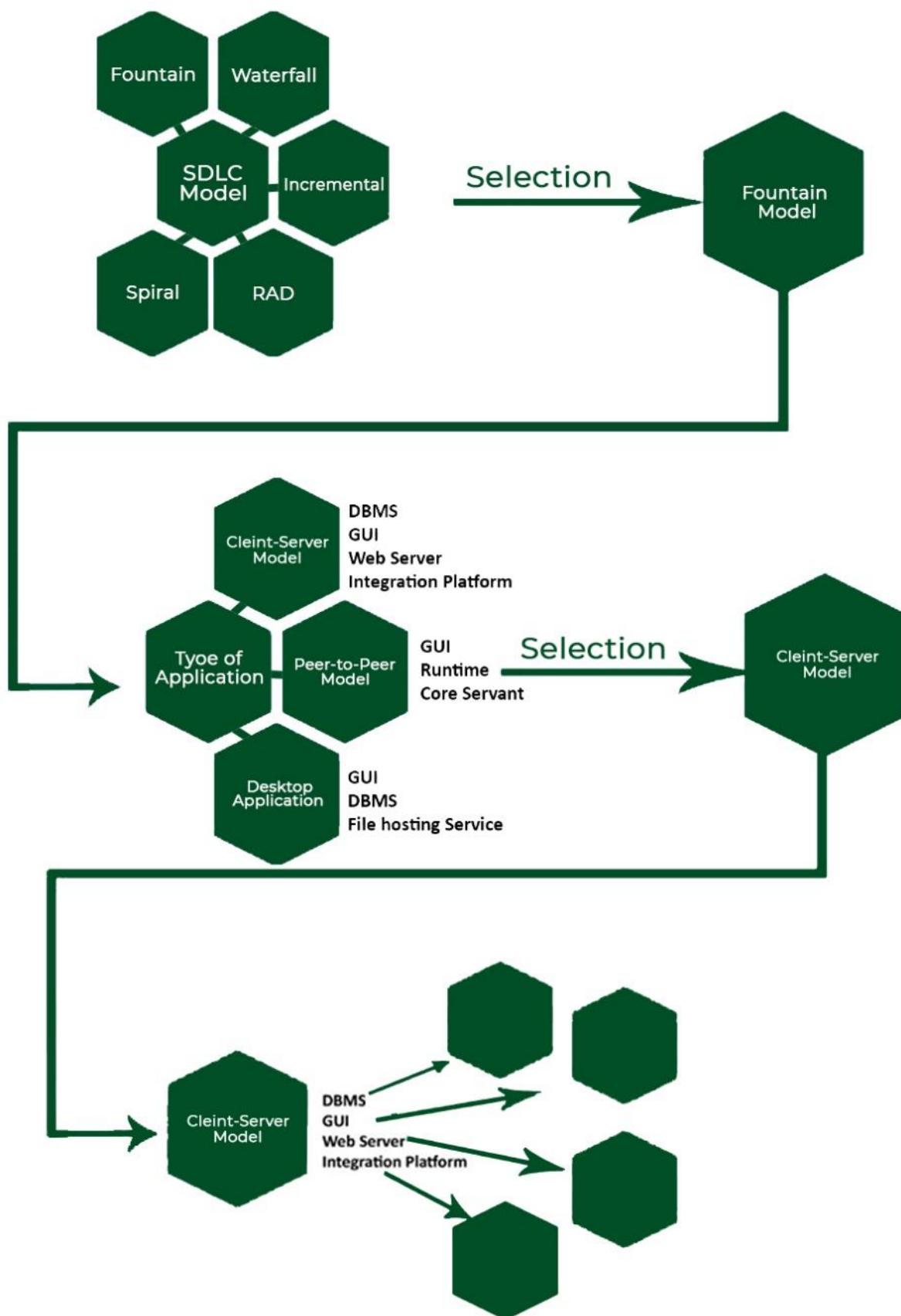


Figure 31: Selection of Language for Building Blocks of Client - Server Model

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

The selection of the most appropriate language is given below.

### 4.2.1. Database Management System

#### 4.2.1.1. List of Criteria

The criteria for selection of DBMS language is as follows:

*Table 6: List of Criteria for Selection of DBMS Language*

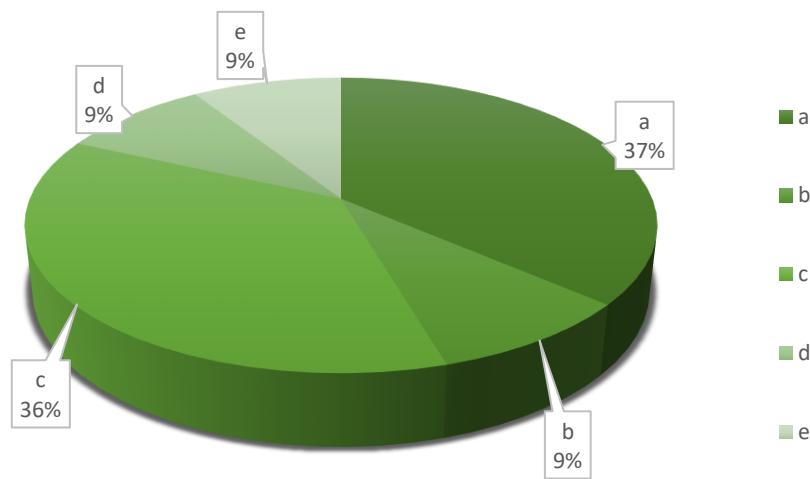
a	Difficulty Level (in terms of learning)
b	Prior knowledge
c	Usability (ease of use for us)
d	Integration with another used framework
e	Learning material availability

#### 4.2.1.2. Criteria Weighing

Each criterion has been assigned a certain weightage.

*Table 7: Criteria Weighing for DBMS Language Selection*

	a	b	c	d	e	sum	weight (%)
a	1	1	1	1	1	4	36.36
b	0	0	0	1	0	1	9.09
c	1	1	0	1	1	4	36.36
d	0	0	1	0	0	1	9.09
e	0	0	1	0	0	1	9.09



**Figure 32: Criteria Weightage Breakdown of DBMS Language Selection**

#### 4.2.1.3. Weighted Rating Matrix

The weighted rating matrix for DBMS language selection is as follows:

**Table 8: Weighted Rating Matrix for DBMS Language Selection**

Criteria	a	b	c	d	e	TOTAL	RANKING
Weightage	36.36	9.09	36.36	9.09	9.09	10.00	
<b>Oracle Database</b>							
Sore out of 10	5.00	2.00	7.00	3.00	6.00	5.36	4th
Weighted Score	1.82	0.18	2.55	0.27	0.55		
<b>MySQL</b>							
Sore out of 10	6	5	7	9	9	6.82	1st
Weighted Score	2.18	0.45	2.55	0.82	0.82		
<b>MS SQL Server</b>							
Sore out of 10	4	2	2	7	7	3.64	5th
Weighted Score	1.45	0.18	0.73	0.64	0.64		
<b>PostgreSQL</b>							
Sore out of 10	4	3	8	2	9	5.64	3rd
Weighted Score	1.45	0.27	2.91	0.18	0.82		

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<b>MongoDB</b>						4.00	6th
Sore out of 10	5	3	3	7	2		
Weighted Score	1.82	0.27	1.09	0.64	0.18	5.27	5th
<b>IBM DB2</b>							
Sore out of 10	4	2	8	3	5	6.36	2nd
Weighted Score	1.45	0.18	2.91	0.27	0.45		
<b>Microsoft Access</b>						4.55	7th
Sore out of 10	6	3	8	5	6		
Weighted Score	2.18	0.27	2.91	0.45	0.55	4.73	5th
<b>Teradata</b>							
Sore out of 10	4	2	7	2	2	3.45	8th
Weighted Score	1.45	0.18	2.55	0.18	0.18		
<b>SAP ASE</b>						3.45	8th
Sore out of 10	7	3	4	2	3		
Weighted Score	2.55	0.27	1.45	0.18	0.27	3.45	8th
<b>Cassandra</b>							
Sore out of 10	5	2	3	2	2	3.45	8th
Weighted Score	1.82	0.18	1.09	0.18	0.18		

### 4.2.1.4. Conclusion

From the above assessment, it is concluded that the most suitable Database Management System language for the current project is MySQL as depicted in Figure 33:

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

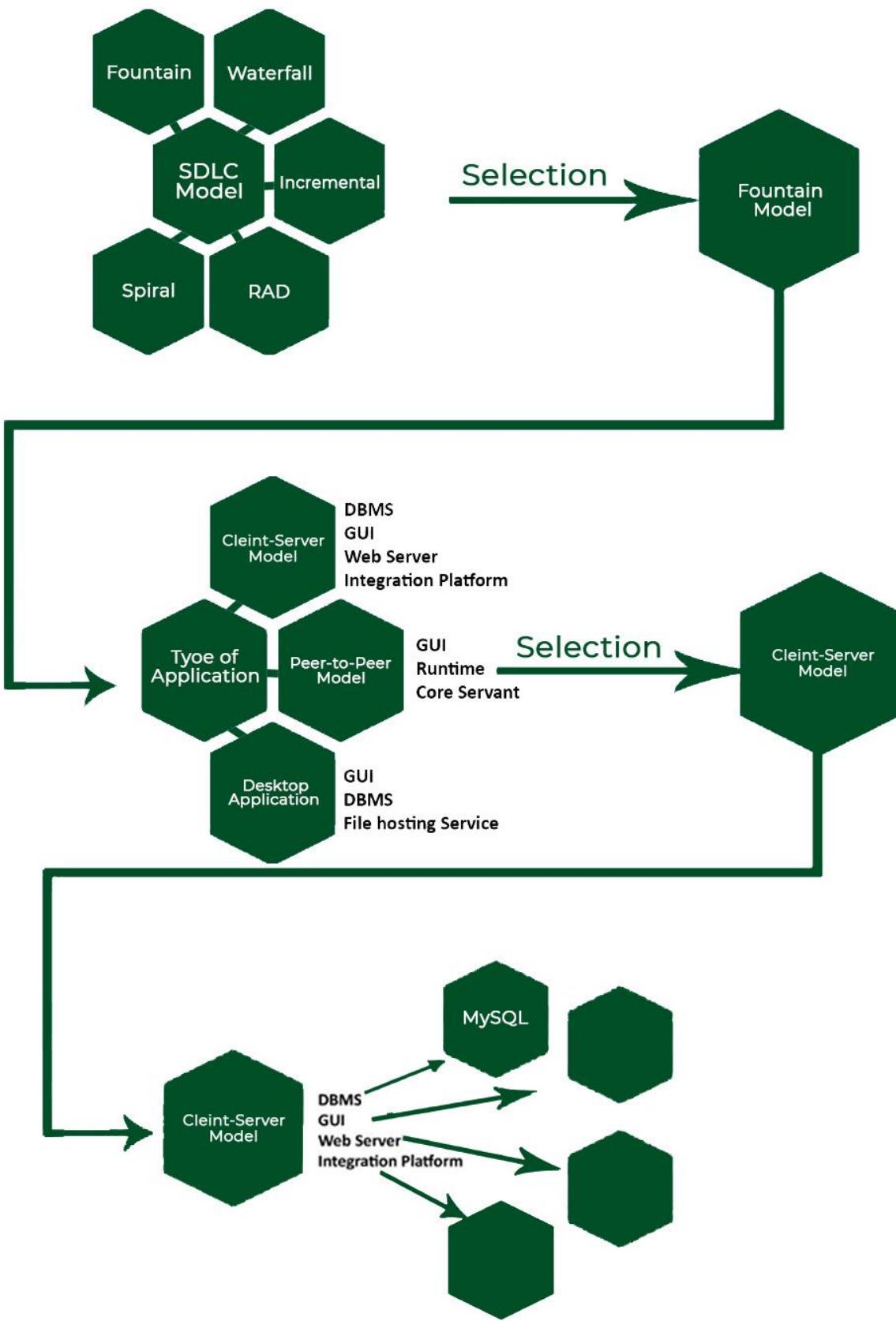


Figure 33: Decision for DBMS Language Selection

### **4.2.2. Graphical User Interface**

After selecting the optimal language for DBMS, we move on towards the second building block of Client – Server Model, which is Graphical User Interface. There are several GUI programming languages and we will select the most optimal language; we will set a criterion and by using the weighted rating matrix tool the decision will be made.

#### **4.2.2.1. List of Criteria**

The criteria for selection of programming language for GUI are as follows

**Table 9: List of Criteria for Selection of GUI Language**

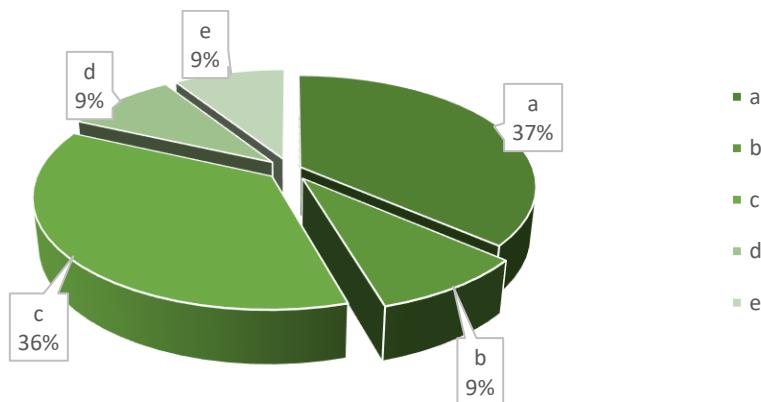
a	Difficulty Level (in terms of learning)
b	Prior knowledge
c	Usability (ease of use for us)
d	Learning material availability
e	Open-source libraries

#### **4.2.2.2. Criteria Weighing**

Each criterion is assigned a certain weight.

**Table 10: Criteria Weighing for Selection of GUI Language**

	a	b	c	d	e	sum	weight (%)
a		1	1	1	1	4	36.36
b	0		0	0	1	1	9.09
c	1	1		1	1	4	36.36
d	0	0	0		1	1	9.09
e	0	0	0	1		1	9.09



**Figure 34: Criteria Weightage Breakdown for Selection of GUI Language**

#### 4.2.2.3. Weighted Rating Matrix

The weighted rating matrix for selection of GUI language is as follows:

**Table 11: Weighted Rating Matrix for Selection of GUI Languages**

Criteria	a	b	c	d	e	TOTAL	RANKING
Weightage	36.36	9.09	36.36	9.09	9.09	100.00	
C#							
Sore out of 10	3.00	4.00	2.00	7.00	6.00	3.36	8th
Weighted Score	1.09	0.36	0.73	0.64	0.55		
C/C++							
Sore out of 10	4	4	2	5	5	3.45	8th
Weighted Score	1.45	0.36	0.73	0.45	0.45		
JavaScript							
Sore out of 10	5	4	6	7	7	5.64	4th
Weighted Score	1.82	0.36	2.18	0.64	0.64		
Objective C							
Sore out of 10	7	8	2	4	4	4.73	6th

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<b>Weighted Score</b>	2.55	0.73	0.73	0.36	0.36		
<b>Ruby</b>							
<b>Sore out of 10</b>	6	4	5	3	7	5.27	5th
<b>Weighted Score</b>	2.18	0.36	1.82	0.27	0.64		
<b>HTML/CSS</b>							
<b>Sore out of 10</b>	9	8	9	9	8	8.82	1st
<b>Weighted Score</b>	3.27	0.73	3.27	0.82	0.73		
<b>Swift</b>							
<b>Sore out of 10</b>	5	2	4	3	3	4.00	8th
<b>Weighted Score</b>	1.82	0.18	1.45	0.27	0.27		
<b>Java</b>							
<b>Sore out of 10</b>	8	5	8	7	8	7.64	2nd
<b>Weighted Score</b>	2.91	0.45	2.91	0.64	0.73		
<b>Python</b>							
<b>Sore out of 10</b>	7	6	8	6	2	6.73	3rd
<b>Weighted Score</b>	2.55	0.55	2.91	0.55	0.18		
<b>Perl</b>							
<b>Sore out of 10</b>	5	3	7	3	2	5.09	7th
<b>Weighted Score</b>	1.82	0.27	2.55	0.27	0.18		

### 4.2.2.4. Conclusion

From the above assessment, it is certain that the best language for building a graphical user interface is HTML and CSS as shown in Figure 35:

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

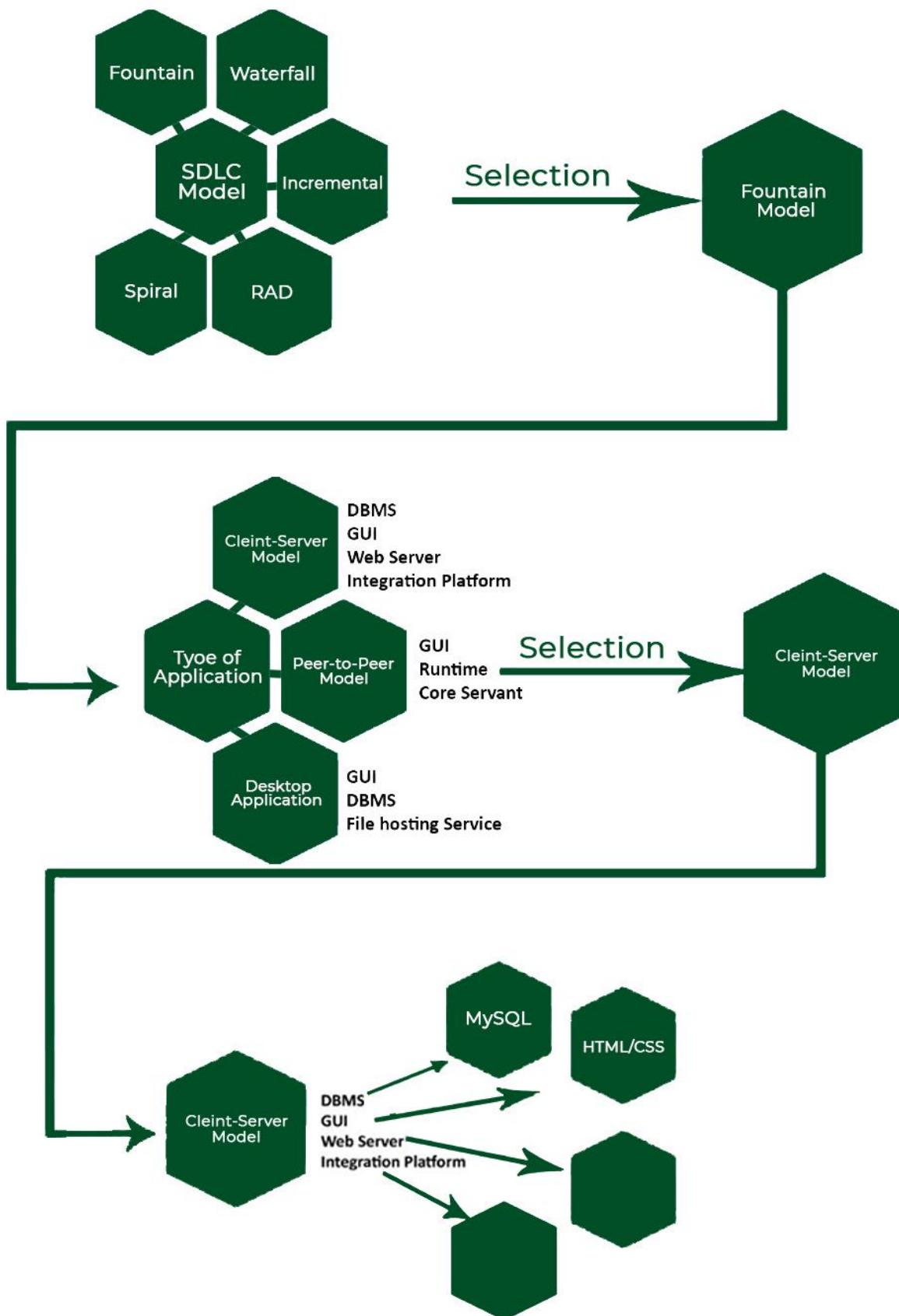


Figure 35: Decision for GUI Language Selection

### **4.2.3. Web Server**

The Web Server is the third building block of Client – Server Model. Same process will be carried out for selection of Web Server as previously done for DBMS, and GUI.

#### **4.2.3.1. List of Criteria**

The criteria for selection of Web Server are as follows;

**Table 12: List of Criteria for Selection of Web Server:**

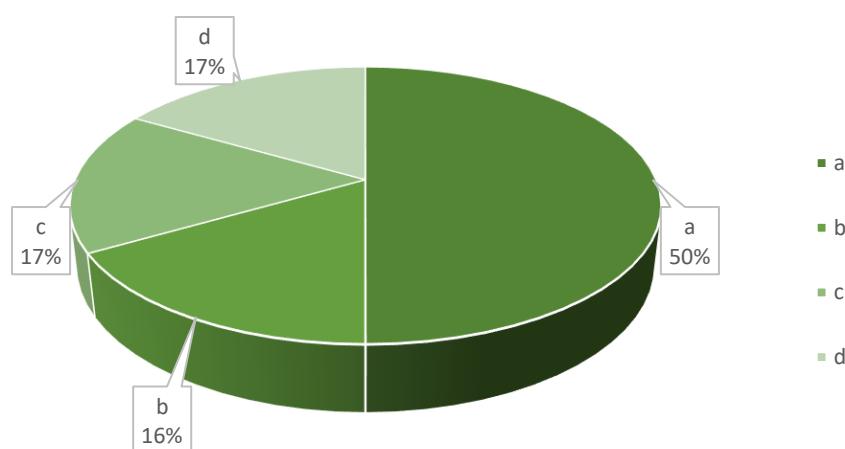
A	Cost
B	Speed of Access
C	Disk Space
D	File type

#### **4.2.3.2. Criteria Weighing**

Each criterion is assigned a certain weight. It is shown in Table 14:

**Table 13: Criteria Weighing for Selection of Web Server**

	a	b	c	d	sum	weight (%)
a	1	1	1	1	3	50.00
b	1	0	0	0	1	16.67
c	1	0	0	0	1	16.67
d	1	0	0	0	1	16.67



**Figure 36: Criteria Weightage Breakdown for Selection of Web Server**

#### **4.2.3.3. Weighted Rating Matrix**

The weighted rating matrix for selection of Web Server is as follows:

**Table 14: Weighted Rating Matrix for Selection of Web Server**

Criteria	a	b	c	d	TOTAL	RANKING
<b>Weightage</b>	<b>50.00</b>	<b>16.67</b>	<b>16.67</b>	<b>16.67</b>	10.00	
<b>Apache HTTP</b>						
Sore out of 10	5.00	7.00	8.00	3.00	5.50	2nd
Weighted Score	2.50	1.17	1.33	0.50		
<b>NGINX</b>						
Sore out of 10	4	7	6	3	4.67	3rd
Weighted Score	2.00	1.17	1.00	0.50		
<b>Apache Tomcat</b>						
Sore out of 10	10	5	5	9	8.17	1st
Weighted Score	5.00	0.83	0.83	1.50		
<b>Node.js</b>						
Sore out of 10	3	8	6	2	4.17	5th
Weightage	1.50	1.33	1.00	0.33		
<b>Tengine</b>						
Sore out of 10	4	7	6	1	4.33	5th
Weighted Score	2.00	1.17	1.00	0.17		
<b>Mongrel2</b>					4.17	4th

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<b>Sore out of 10</b>	2	8	4	7		
<b>Weighted Score</b>	1.00	1.33	0.67	1.17		
<b>Oracle iPlanet</b>						
<b>Sore out of 10</b>	4	4	5	9		
<b>Weighted Score</b>	2.00	0.67	0.83	1.50		
<b>LiteSpeed</b>						
<b>Sore out of 10</b>	2	9	4	7		
<b>Weighted Score</b>	1.00	1.50	0.67	1.17		

### 4.2.3.4. Conclusion

From the above assessment, it is concluded that the most suitable Web Server for the current project is Apache Tomcat. The decision is depicted in Figure 37:

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

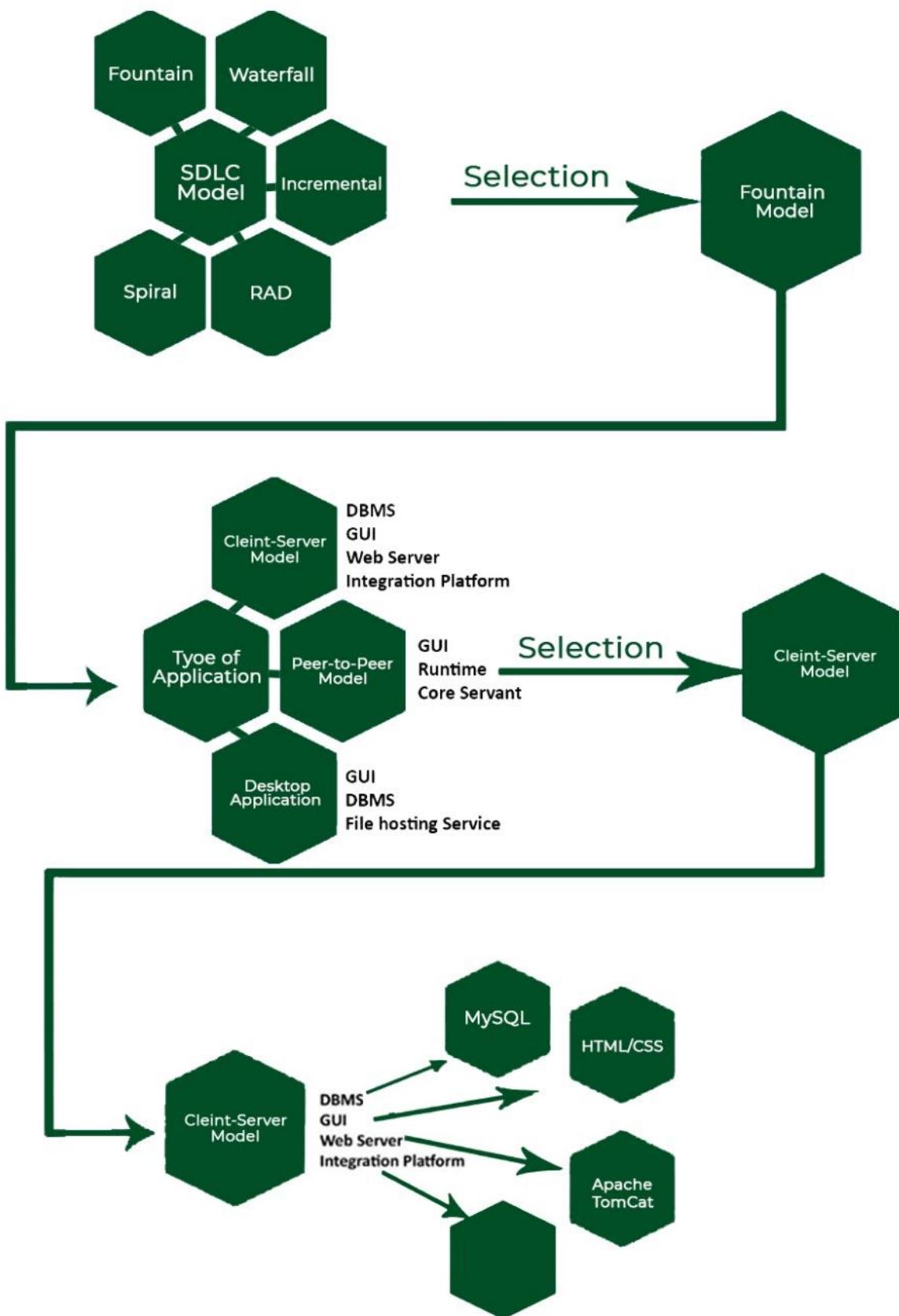


Figure 37: Decision for Selection of Web Server

#### 4.2.4. Integration Platform

Integration Platform is the 4<sup>th</sup> building block for Client – Server Model. The selection process for most optimal language for integration platform is as follows;

##### 4.2.4.1. List of Criteria

The criteria for selection of Web Server are as follows;

*Table 15: List of Criteria for Selection of Integration Platform*

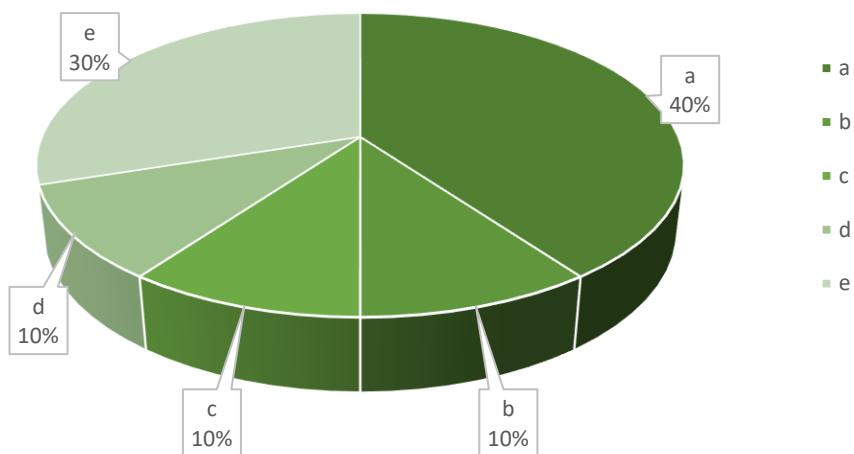
a	Difficulty Level (in terms of learning)
b	Prior knowledge
c	Compatible with the MVC paradigm
d	Open-source libraries
e	Debugging ease

##### 4.2.4.2. Criteria Weighing

Each criterion is assigned a certain weight:

*Table 16: Criteria Weighing for Selection of Integration Platform*

	a	b	c	d	e	sum	Weight (%)
a	1	1	1	1	1	4	40.00
b	0	0	1	0	0	1	10.00
c	1	0	0	0	0	1	10.00
d	0	1	0	0	0	1	10.00
e	1	0	1	1	0	3	30.00



**Figure 38: Criteria Weightage Breakdown for Selection of Integration Platform**

#### **4.2.4.3. Weighted Rating Matrix**

The weighted rating matrix for selection of Integrated Platform is as follows

**Table 17: Weighted Rating Matrix for Selection of Integration Platform**

Criteria	a	b	c	d	e	TOTAL	RANKING
Weightage	40.00	10.00	10.00	10.00	30.00	10.00	
<b>ASP .NET</b>							
Sore out of 10	7.00	2.00	6.00	3.00	4.00	5.10	3rd
Weighted Score	2.80	0.20	0.60	0.30	1.20		
<b>Java Server Faces</b>							
Sore out of 10	9	6	8	8	7	7.90	1st
Weighted Score	3.60	0.60	0.80	0.80	2.10		
<b>MyBaits</b>							
Sore out of 10	5	1	6	3	7	5.10	2nd
Weighted Score	2.00	0.10	0.60	0.30	2.10		
<b>Spark</b>							
Sore out of 10	6	3	3	1	3	4.00	5th

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<b>Weighted Score</b>	2.40	0.30	0.30	0.10	0.90		
<b>Hibernate</b>							
<b>Sore out of 10</b>	3	2	3	5	4		
<b>Weighted Score</b>	1.20	0.20	0.30	0.50	1.20	3.40	4th

### 4.2.4.4. Conclusion

The above weighted rated matrix shows that the most suitable integration platform for under consideration software is Java Faces Server. The final decision of language selection for all four building blocks of Client – Server Model is depicted in Figure 39

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

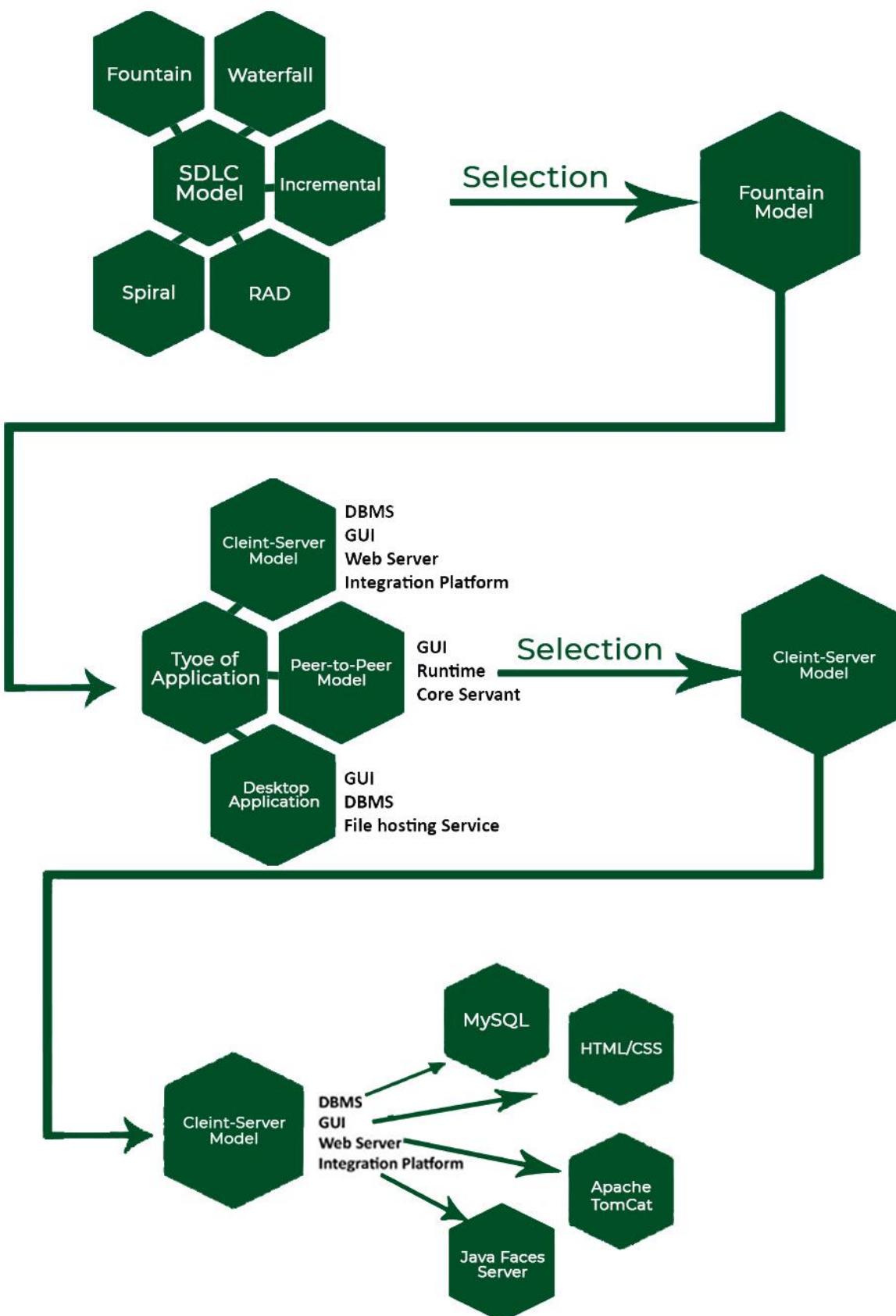


Figure 39: Decision for Selection of Integration Platform

## 5. ACTION PLAN

In order to move forward in the project a course of action was developed. This course of action is what is termed as the action plan. This plan will help us to assess our progress in the project and to set make other plans in accordance with it.

The action plan was made in accordance with Fountain Model of Software Development Life Cycle. It is divided into seven stages as depicted in Figure 40:

### 5.1. Analysis

First stage is the analysis phase. In this stage problem is analyzed, the process is understood and described.

### 5.2. Requirement

In second stage, which is the requirement stage, the aim and scope of the project is defined, statement of requirement is made and data collection starts.

### 5.3. Design

In their stage, i.e. Design Phase, the language selection take place and data is analyzed to move further for coding phase.

### 5.4. Coding

In this stage the software is developed using the previously selected languages and all modules are integrated.

### 5.5. Testing and Integration

This phase, like all other phases is overlapped with the previous one. The testing and debugging are carried out simultaneously with the coding and proper software is created.

### 5.6. Operation

In sixth stage, the implementation of software is done along with the training of employees.

### 5.7. Maintenance

Seventh and last stage is about maintaining the quality of software at the workplace. The debugging of software is done later in as required in its life cycle.

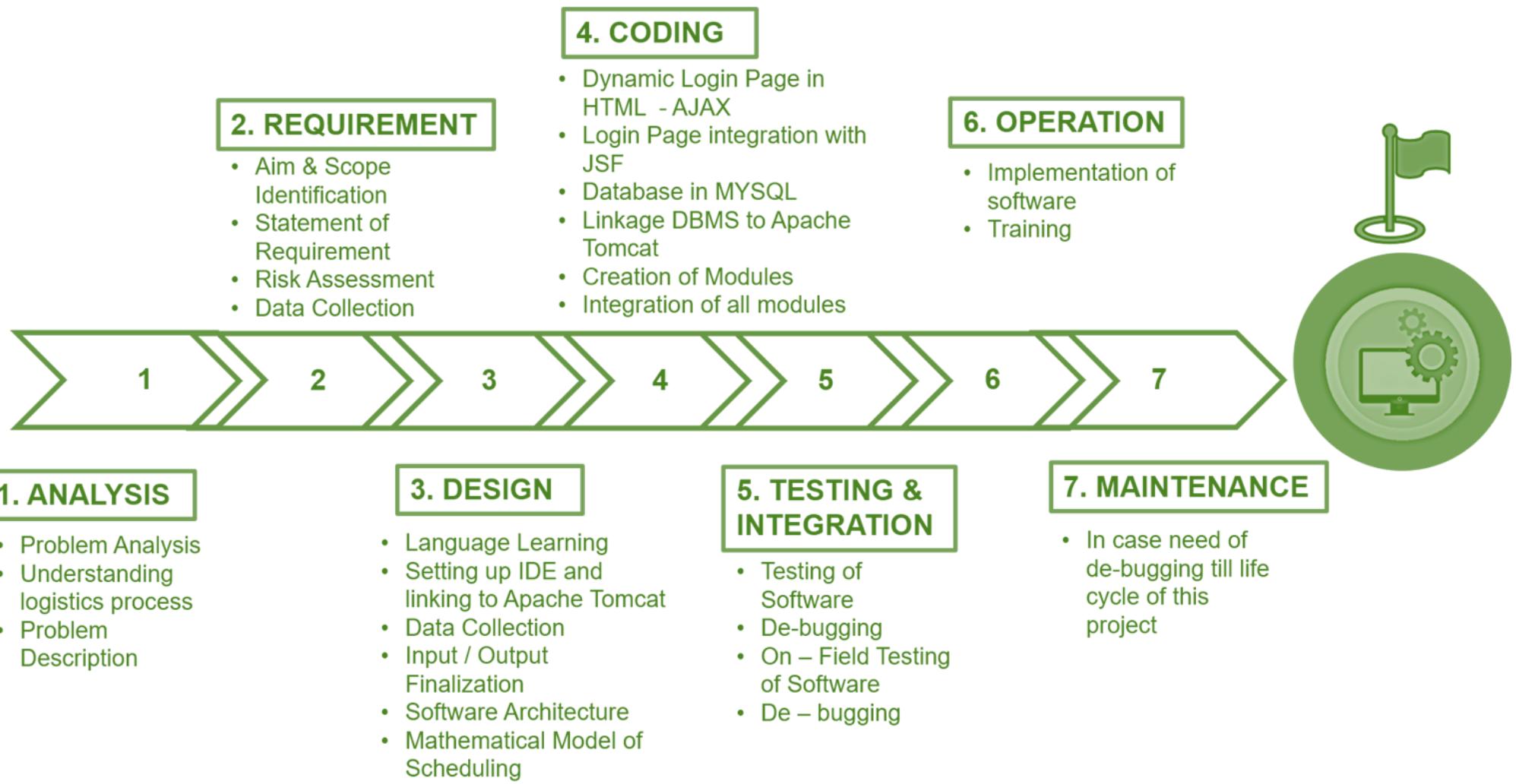


Figure 40: Action Plan

## 6. PROJECT METHODOLOGY

This section elaborates on our strategy to develop the enterprise resource planning software. Along with it, this section also contains the activities required prior to actual development of ERP system, and their detailed description. It also, elaborates on the process of development and implementation of the software.

Let us start with understanding the logistics process in detail and figure out the requirement at each stage of the logistics process.

### 6.1. Requirements Within Logistics Process

To develop an ERP software for the management of logistics process of the industry, the detailed understanding of the process with respect to the software is required. When, and from where the coal is picked up, how much can be transported via which method, etc.

An in-depth analysis was required. It is mentioned in segment [2], the logistics process of the company starts with the placement of order of coal, which then shipped in to country via sea and docked at Muhammad Bin Qasim Port, in Karachi.

Since the project required the automation of completed process in terms of data recording, it was important for us to understand the current flow. We divided the steps wherever was the need and combine them too accordingly. Each step has been thoroughly studies and how software is going to aid in each step of the process is identified and mentioned below and depicted in Figure 41:

#### 6.1.1. Placement of Order

The placement of order of coal is the first step in logistics process. The software will be taking care of following factors, saving them in database.

- 6.1.1.1. When order is placed
- 6.1.1.2. Amount of coal
- 6.1.1.3. Expected date it will be shipped-in
- 6.1.1.4. Possibly duty on that amount

#### 6.1.2. Coal Shipped-In

After the coal is shipped in the following data is required.

- 6.1.2.1. Amount of coal received
- 6.1.2.2. Date it is received
- 6.1.2.3. Amount for which duty is paid?

These data sets are going to help the software in making the schedule of transportation of coal. The amount received will be set to the amount of coal order initially, though software also provide option to alter that information later on as needed.

#### 6.1.3. Coal Is Picked Up from Port with Their Destinations

After the coal is shipped-in, the extraction it from port is next step. The coal is picked up from the port via trucks after payment of duty against an index. The user will enter the information of how much coal has been picked in what truck against which index and what was the destination of that coal.

## **Development of ERP Software Solution for Logistics Management of Maple Leaf Cement**

The software will save these set of data into the database and later will be used to alter the Transportation Schedule and will be summarized in the report; automatically generated by the software as needed.

### **6.1.3.1. Loan**

The coal, that is picked from port, is either transported to plant, to warehouse or loaned to another company. The MLC loaned the coal when they are unable to pick the coal from port within given time, it is due to unavailability of trucks or cash for payment of duty.

Following detailed will be tracked in this section:

- 6.1.3.1.1. How much amount is loaned?
- 6.1.3.1.2. Date it was loaned
- 6.1.3.1.3. When will it be returned?

### **6.1.3.2. Truck**

The trucks are used to either transport the coal to warehouse or to the plant directly. Whenever the coal is picked from port via truck the following details will be entered in the software along with some other explained in section 7].

The details software will be keeping track of are

- 6.1.3.2.1. Amount of coal
- 6.1.3.2.2. Details of truck
- 6.1.3.2.3. Date and time
- 6.1.3.2.4. The destination
- 6.1.3.2.5. Expected time to reach the plant
- 6.1.3.2.6. When alarm should be raised

### **6.1.4. Received at Warehouse**

The warehouse is the place, where coal resided before sending it to plant. From warehouse coal is transported to plant via truck or via railway carriages. The detail that needed to be tracked here is divided into 3 sub sections; Train, Truck and coal left at warehouse.

#### **6.1.4.1. Train**

The trains are used to transport coal to plant from warehouse. A fixed amount is needed to be transported by train each month as per the contract between the company and Pakistan Railway. The following details will be tracked by software

- 6.1.4.1.1. Amount of coal transported
- 6.1.4.1.2. Details of train compartment
- 6.1.4.1.3. Amount of coal present/left at warehouse
- 6.1.4.1.4. Date and time of start of transportation
- 6.1.4.1.5. Expected date to reach plant
- 6.1.4.1.6. Is it reached at plant or not?
- 6.1.4.1.7. The alarm system

#### **6.1.4.2. Truck**

The trucks are used to either transport the coal to warehouse or to the plant directly. Whenever the coal is picked from port via truck the following details will be entered in the software along with some other explained in section 7].

The details software will be keeping track of are

- 6.1.4.2.1. Amount of coal
- 6.1.4.2.2. Details of truck
- 6.1.4.2.3. Date and time
- 6.1.4.2.4. The destination
- 6.1.4.2.5. Expected time to reach the plant
- 6.1.4.2.6. When alarm should be raised

#### **6.1.4.3. Amount of Coal Present**

The amount of coal present at warehouse is transported to plant via truck and train. The transportation depends upon two important factors

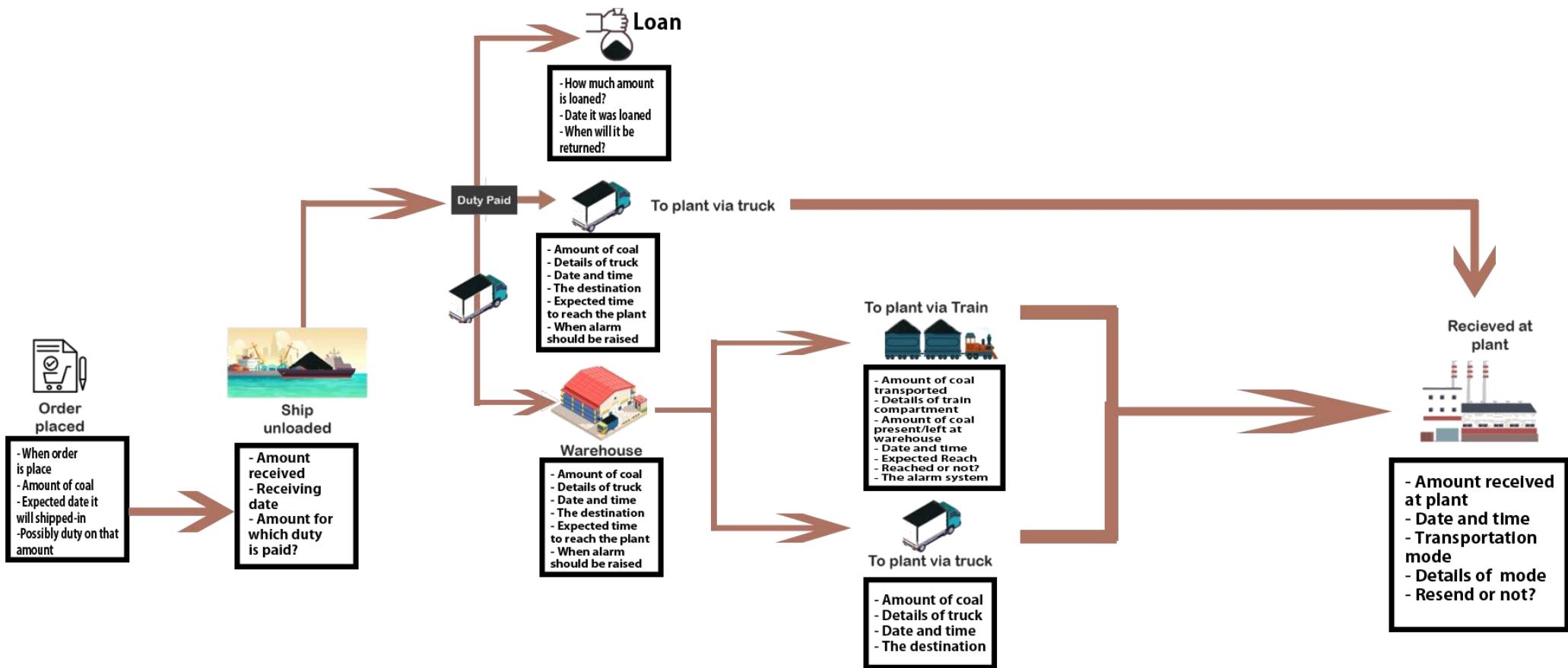
- 6.1.4.3.1. Requirement at plant
- 6.1.4.3.2. Availability of wagons of train
- 6.1.4.3.3. Availability of truck

#### **6.1.5. Received at Plant**

This is the last stage of the logistics process under consideration.

- 6.1.5.1. Amount received at plant
- 6.1.5.2. Date and time
- 6.1.5.3. Transportation mode
- 6.1.5.4. Details of transportation mode
- 6.1.5.5. Is the same truck/train is going to be used to send cement from plant to Karachi?

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement



**Figure 41: Requirements Within Logistic Process**

## 6.2. In-Depth Analysis of Logistics Process Data

In this section we will study the logistics process data that is being recorded currently. We have to study this information to see how all the data pointers mentioned in previous section 6.1] being recorded.

The logistics process is carried out by two transportation means, that is Via Truck and Via train. The date that is recoded currently are mentioned below,

### 6.2.1. By Train

The coal present at warehouse is transported to plant via train. The transportation depends upon the requirement of coal at plant and availability of wagons of train. The following data is the sample, that has been entered at when train dispatches, and when the train has delivered the coal to plant

<b>MAPLE LEAF CEMENT FACTORY LTD</b>																								
<b>DETAIL OF RAILWAY FREIGHT OF COAL LOADED AGAINST M.V I Kan Sembak (Coal)</b>																								
SR #	R R #	INV.#	LOD.DATE	RR DATE	WAGON #	WEAGHT	TOTAL	CHARGED	FREIGHT	LHC	LMC	D/ CHARGED	SIDING	25 PERCENT	OVERLOAD	TOTAL	Round Amount	TOTAL PAYMENT	ROUTE	PAYMENT	P/ O NO	DATE	BALANCE	W/MENT CASH
1	225193	361	8-May-14	10-May-14	92128	56.6	56.6	58	118320	2220	.	.	.	.	.	120540	120540	I Kan Sembak-1	WAGON					240
2	225192	360	8-May-14	10-May-14	92328	57.9													I Kan Sembak-1	WAGON			240	
3	225192	360	8-May-14	10-May-14	92222	57.7													I Kan Sembak-1	WAGON			240	
4	225192	360	8-May-14	10-May-14	92204	57.5													I Kan Sembak-1	WAGON			240	
5	225192	360	8-May-14	10-May-14	92338	57.6													I Kan Sembak-1	WAGON			240	
6	225192	360	8-May-14	10-May-14	92161	58.3	289	290.3	592212	11100	.	.	.	.	.	603312	603315	I Kan Sembak-1	WAGON					240
7	225191	359	8-May-14	10-May-14	95067	59.3													I Kan Sembak-1	WAGON			240	
8	225191	359	8-May-14	10-May-14	95073	58.3													I Kan Sembak-1	WAGON			240	
9	225191	359	8-May-14	10-May-14	95236	58.7													I Kan Sembak-1	WAGON			240	
10	225191	359	8-May-14	10-May-14	95081	56.7													I Kan Sembak-1	WAGON			240	
11	225191	359	8-May-14	10-May-14	92288	57.4	290.4	294.3	600372	11100	.	.	.	.	.	611472	611475	I Kan Sembak-1	WAGON					240
12	225190	358	8-May-14	10-May-14	92175	58.1													I Kan Sembak-1	WAGON			240	
13	225190	358	8-May-14	10-May-14	95308	56.5	114.6	117.1	238884	4440	.	.	.	.	.	243324	243325	I Kan Sembak-1	WAGON					240
14	225229	377	8-May-14	26-May-14	92312	57													I Kan Sembak-1	WAGON			240	
15	225229	377	8-May-14	26-May-14	92452	58.7													I Kan Sembak-1	WAGON			240	
16	225229	377	8-May-14	26-May-14	92206	59.5	175.2	176.2	359448	6660	.	.	.	.	.	366108	366110	I Kan Sembak-1	WAGON					240
17	225232	380	9-May-14	26-May-14	92355	58.3													I Kan Sembak-1	WAGON			240	
18	225232	380	9-May-14	26-May-14	95129	58.1													I Kan Sembak-1	WAGON			240	
19	225232	380	9-May-14	26-May-14	92014	58.4													I Kan Sembak-1	WAGON			240	
20	225232	380	9-May-14	26-May-14	95171	57.8													I Kan Sembak-1	WAGON			240	
21	225232	380	9-May-14	26-May-14	95120	57.3	289.9	293.7	599148	11100	.	.	.	.	.	610248	610250	I Kan Sembak-1	WAGON					240

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22	225231	379	9-May-14	26-May-14	95031	60.8									I Kan Sembak-1	WAGON					240		
23	225231	379	9-May-14	26-May-14	95136	58.8	119.6	119.8	244392	4440					248832	248832	I Kan Sembak-1	WAGON			240		
						1335.3												2803847		4141615		1337768	5520
1	225231	379	9-May-14	26-May-14	95189	60.5									I Kan Sembak-2	WAGON					240		
2	225231	379	9-May-14	26-May-14	92093	59.3	119.8	119.8	244392	4440					248832	248833	I Kan Sembak-2	WAGON			240		
3	225230	378	9-May-14	26-May-14	95221	59.4	59.4	59.4	121176	2220	.	.	.	.	123396	123396	I Kan Sembak-2	WAGON	1337768		240		
4	225231	379	9-May-14	26-May-14	95040	59	59	59	120360	2220	.	.	.	.	122580	122580	I Kan Sembak-2	WAGON			240		
5	225230	378	9-May-14	26-May-14	95267	58.6									I Kan Sembak-2	WAGON					240		
6	225230	378	9-May-14	26-May-14	95095	58.6									I Kan Sembak-2	WAGON					240		
7	225230	378	9-May-14	26-May-14	95301	58.8									I Kan Sembak-2	WAGON					240		
8	225230	378	9-May-14	26-May-14	95029	59.7	235.7	236.7	48268	8880	.	.	.	.	491748	491749	I Kan Sembak-2	WAGON			240		
9	225234	382	10-May-14	26-May-14	92314	58.8									I Kan Sembak-2	WAGON					240		
10	225234	382	10-May-14	26-May-14	92028	57.6									I Kan Sembak-2	WAGON					240		
11	225234	382	10-May-14	26-May-14	92353	58.9									I Kan Sembak-2	WAGON					240		
12	225234	382	10-May-14	26-May-14	95254	59	234.3	234.7	478788	8880	.	.	.	.	487668	487670	I Kan Sembak-2	WAGON			240		
13	225233	381	10-May-14	26-May-14	95287	58.7									I Kan Sembak-2	WAGON					240		
14	225233	381	10-May-14	26-May-14	95100	59.8									I Kan Sembak-2	WAGON					240		
15	225233	381	10-May-14	26-May-14	95187	58.5									I Kan Sembak-2	WAGON					240		
16	225233	381	10-May-14	26-May-14	92230	59.5									I Kan Sembak-2	WAGON					240		
17	225233	381	10-May-14	26-May-14	95329	59.1	295.6	296.4	604656	11100	.	.	.	.	615756	615760	I Kan Sembak-2	WAGON			240		
18	225238	386	10-May-14	26-May-14	95300	58.2									I Kan Sembak-2	WAGON					240		
19	225238	386	10-May-14	26-May-14	92391	58.9									I Kan Sembak-2	WAGON					240		
20	225238	386	10-May-14	26-May-14	95334	59.1									I Kan Sembak-2	WAGON					240		
21	225238	386	10-May-14	26-May-14	95278	59.4	235.6	236.4	482256	8880	.	.	.	.	491136	491140	I Kan Sembak-2	WAGON			240		
22	225237	385	10-May-14	26-May-14	95208	60.2									I Kan Sembak-2	WAGON					240		
23	225237	385	10-May-14	26-May-14	95094	59.4	119.6	119.6	243984	4440	.	.	.	.	248424	248425	I Kan Sembak-2	WAGON			240		
						1359									2829533	WAGON	1337768		-1491785	5520			
1	225270	398	12-May-14	4-Jun-14	92383	59.5	59.5	59.5	121380	2220	2220	.	.	2220	128040	128040	I Kan Sembak-3	WAGON			480		
2	225237	385	12-May-14	26-May-14	95153	59.5									I Kan Sembak-3	WAGON		-1491785			240		
3	225237	385	12-May-14	26-May-14	92359	59.8	119.3	119.3	243372	4440	.	.	.	.	247812	247815	I Kan Sembak-3	WAGON			240		
4	225236	384	12-May-14	26-May-14	95332	58.8									I Kan Sembak-3	WAGON					240		
5	225236	384	12-May-14	26-May-14	95275	58.4									I Kan Sembak-3	WAGON					240		
6	225236	384	12-May-14	26-May-14	95160	58.9									I Kan Sembak-3	WAGON					240		
7	225236	384	12-May-14	26-May-14	92083	59.2									I Kan Sembak-3	WAGON					240		
8	225236	384	12-May-14	26-May-14	92117	58.6	293.9	294.8	601392	11100	.	.	.	.	612492	612495	I Kan Sembak-3	WAGON			240		
9	225235	383	12-May-14	26-May-14	95013	58.4									I Kan Sembak-3	WAGON					240		
10	225235	383	12-May-14	26-May-14	92411	58.2									I Kan Sembak-3	WAGON					240		
11	225235	383	12-May-14	26-May-14	95198	58.7									I Kan Sembak-3	WAGON					240		
12	225235	383	12-May-14	26-May-14	95173	59.2									I Kan Sembak-3	WAGON					240		
13	225235	383	12-May-14	26-May-14	95246	59.3	293.8	294.7	601188	11100	.	.	.	.	612288	612290	I Kan Sembak-3	WAGON			240		
14	225239	387	12-May-14	26-May-14	95273	58.8									I Kan Sembak-3	WAGON					240		
15	225239	387	12-May-14	26-May-14	95089	58.7									I Kan Sembak-3	WAGON					240		
16	225239	387	12-May-14	26-May-14	95248	58.6									I Kan Sembak-3	WAGON					240		
17	225239	387	12-May-14	26-May-14	95280	59									I Kan Sembak-3	WAGON					240		
18	225239	387	12-May-14	26-May-14	95140	59	294.1	295	601800	11100	.	.	.	.	612900	612900	I Kan Sembak-3	WAGON			240		

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21	225241	389		13-May-14	26-May-14	95183	57.4										I Kan Sembak-4	WAGON						240		
22	225241	389		13-May-14	26-May-14	95214	58.4										I Kan Sembak-4	WAGON						240		
23	225241	389		13-May-14	26-May-14	95331	58.6	291.3	294.6	600984	11100	.	.	.	.	612084	612085	I Kan Sembak-4	WAGON						240	
						1355.2											2818125	WAGON	-4318635					-7136760	5520	
1	225225	373		13-May-14	24-May-14	95053	61										I Kan Sembak-5	WAGON						240		
2	225225	373		13-May-14	24-May-14	95176	59.5										I Kan Sembak-5	WAGON						240		
3	225225	373		13-May-14	24-May-14	92260	59.9	180.4	180.4	368016	6660	.	.	.	.	374676	374670	I Kan Sembak-5	WAGON	-7136760					240	
4	225224	372		13-May-14	24-May-14	92272	59.2										I Kan Sembak-5	WAGON						240		
5	225224	372		13-May-14	24-May-14	95249	59.5										I Kan Sembak-5	WAGON						240		
6	225224	372		13-May-14	24-May-14	92368	59.3										I Kan Sembak-5	WAGON						240		
7	225224	372		13-May-14	24-May-14	92032	57.9										I Kan Sembak-5	WAGON						240		
8	225224	372		13-May-14	24-May-14	95121	58.7	294.6	295	601800	11100	.	.	.	.	612900	612900	I Kan Sembak-5	WAGON						240	
9	225223	371		13-May-14	24-May-14	92333	59										I Kan Sembak-5	WAGON						240		
10	225223	371		13-May-14	24-May-14	92420	59.5										I Kan Sembak-5	WAGON						240		
11	225223	371		13-May-14	24-May-14	92008	58										I Kan Sembak-5	WAGON						240		
12	225223	371		13-May-14	24-May-14	92001	57.9										I Kan Sembak-5	WAGON						240		
13	225223	371		13-May-14	24-May-14	95113	59.5	293.9	294	599760	11100	.	.	.	.	610860	610860	I Kan Sembak-5	WAGON						240	
14	225226	374		13-May-14	24-May-14	95258	58.5										I Kan Sembak-5	WAGON						240		
15	225226	374		13-May-14	24-May-14	92169	59										I Kan Sembak-5	WAGON						240		
16	225226	374		13-May-14	24-May-14	92041	57.4										I Kan Sembak-5	WAGON						240		
17	225226	374		13-May-14	24-May-14	92176	58	232.9	234	477360	8880	.	.	.	.	486240	486240	I Kan Sembak-5	WAGON						240	
18	225225	373		13-May-14	24-May-14	92376	58										I Kan Sembak-5	WAGON						240		
19	225225	373		13-May-14	24-May-14	92101	58.3	116.3	116.3	237252	4440	.	.	.	.	241692	241700	I Kan Sembak-5	WAGON						240	
20	225227	375		14-May-14	24-May-14	92154	57.6										I Kan Sembak-5	WAGON						240		
21	225227	375		14-May-14	24-May-14	92459	57.4	115	116	236640	4440	.	.	.	.	241080	241080	I Kan Sembak-5	WAGON						240	
22	225246	394		14-May-14	26-May-14	95082	57.6										I Kan Sembak-5	WAGON						240		
23	225246	394		14-May-14	26-May-14	95335	59.5	117.1	118.5	241740	4440	.	.	.	.	246180	246180	I Kan Sembak-5	WAGON						240	
			TOTAL			6755.0	6755.0	6785.0	13842216	255300	2220	0	0	0	2220	14101956	14092005									
						1350.2											2813630	WAGON	-7136760						-9950390	5520

**Figure 42: Currently Record Data at MLC for Transportation of Coal Via Train<sup>1</sup>**

### 6.2.2. Explanation of Currently Recorded Data for Train

The description of data present in Figure 42 is explained in Table 18

<sup>1</sup> Figure 42 contains sample of the data. Complete data is not shown in this report.

***Table 18: Description of Currently Recorded Data for Transportation of Coal Via Train***

S.NO.	Currently Recorded Data	Explanation
1.	RR#	Railway Receipt Number.
2.	INV#	Invoice Number. It is issued by the Pakistan Railway for each wagon.
3.	LOD. Date	Loading Date. The date on which the coal was loaded in a certain wagon of certain Railway rack number
4.	RR Date	Railway Receipt Date. The date on which the railway receipt was provided.
5.	WAGON #	Wagon number. It is the identification number on each carriage of railway.
6.	FREIGHT	It is the charges of each wagon transportation
7.	LHC	It is the railway charges
8.	LMC	It is the railway charges
9.	WEAGHT	Weight of the coal
10.	Sliding	It indicates the station
11.	Total	It is the sum of WEAGHT with same invoice numbers.
12.	Charged	It is the amount (approx. to Total) weigh by the railway.
13.	W/MENT CASH	It is weighment charges
14.	Vessel Name	It is the name of shipped from which the under-consideration coal was extracted and transported via train.

### **6.2.3. By Road**

The trucks transport the coal from port/warehouse to warehouse/plant. Similarly, as we analyzed the data in section 6.2.1 we analyzed the currently recorded data for transportation of coal via truck too. The data shown here, indicates the details of transportation of coal by truck. It is either picked from port and transported to warehouse or plant, or picked from warehouse and transported to plant.

**Development of ERP Software Solution for Logistics Management of Maple Leaf Cement**

**MAPLE LEAF CEMENT FACTORY LTD**

VESSEL NAME: CLEARING AGENT			I Kan Senbak		LOADING POINT DESTINATION		Garoni Yard		
			Awan Trading				KMLG Plant Daud Khel		
S.No	Date	Bility No.	Vehicle No	Weight in Kg	Weight In MT	Rate pmt	Freight	Bility Name	COAL CATEGORY
1	30-Apr-14	7780	TLN-931	51550	51.550	3827	197,281.85	Jick Way Transport Servic	SOUTH AFRICAN COAL
2	30-Apr-14	7781	TLP-913	51590	51.590	3827	197,434.93	Jick Way Transport Servic	SOUTH AFRICAN COAL
3	30-Apr-14	7782	TLK-991	52250	52.250	3827	199,960.75	Jick Way Transport Servic	SOUTH AFRICAN COAL
4	30-Apr-14	7783	TLH-891	51640	51.640	3827	197,626.28	Jick Way Transport Servic	SOUTH AFRICAN COAL
5	30-Apr-14	7784	TLL-929	53940	53.940	3827	206,428.38	Jick Way Transport Servic	SOUTH AFRICAN COAL
6	30-Apr-14	7785	TLU-713	51180	51.180	3827	195,865.86	Jick Way Transport Servic	SOUTH AFRICAN COAL
7	30-Apr-14	7786	TLJ-867	54550	54.550	3827	208,762.85	Jick Way Transport Servic	SOUTH AFRICAN COAL
8	30-Apr-14	7787	TLD-452	55680	55.680	3827	213,087.36	Jick Way Transport Servic	SOUTH AFRICAN COAL
9	30-Apr-14	7788	TLJ-849	56880	56.880	3827	217,679.76	Jick Way Transport Servic	SOUTH AFRICAN COAL
10	30-Apr-14	7789	TLD-337	54310	54.310	3827	207,844.37	Jick Way Transport Servic	SOUTH AFRICAN COAL
11	30-Apr-14	7790	TLL-667	54570	54.570	3827	208,839.39	Jick Way Transport Servic	SOUTH AFRICAN COAL
12	30-Apr-14	7791	TLK-119	55220	55.220	3827	211,326.94	Jick Way Transport Servic	SOUTH AFRICAN COAL
13	30-Apr-14	7792	TLD-836	54600	54.600	3827	208,954.20	Jick Way Transport Servic	SOUTH AFRICAN COAL
14	30-Apr-14	7793	TLM-337	50760	50.760	3827	194,258.52	Jick Way Transport Servic	SOUTH AFRICAN COAL
15	30-Apr-14	7794	TLN-303	53200	53.200	3827	203,596.40	Jick Way Transport Servic	SOUTH AFRICAN COAL
16	30-Apr-14	7795	TLP-919	52870	52.870	3827	202,333.49	Jick Way Transport Servic	SOUTH AFRICAN COAL
17	30-Apr-14	7796	C-1761	55170	55.170	3827	211,135.59	Jick Way Transport Servic	SOUTH AFRICAN COAL
18	30-Apr-14	7797	TLD-719	54950	54.950	3827	210,293.65	Jick Way Transport Servic	SOUTH AFRICAN COAL
19	30-Apr-14	7798	TLC-449	56210	56.210	3827	215,115.67	Jick Way Transport Servic	SOUTH AFRICAN COAL
20	30-Apr-14	7799	LSC-2400	52500	52.500	3827	200,917.50	Jick Way Transport Servic	SOUTH AFRICAN COAL
1	1-May-14	7800	TLK-950	52800	52.800	3827	202,065.60	Jick Way Transport Servic	SOUTH AFRICAN COAL
2	1-May-14	7801	TLM-347	50960	50.960	3827	195,023.92	Jick Way Transport Servic	SOUTH AFRICAN COAL
3	1-May-14	7802	TLM-375	54930	54.930	3827	210,217.11	Jick Way Transport Servic	SOUTH AFRICAN COAL
4	1-May-14	7803	TLU-817	52160	52.160	3827	199,616.32	Jick Way Transport Servic	SOUTH AFRICAN COAL
5	1-May-14	7804	TLT-947	52820	52.820	3827	202,142.14	Jick Way Transport Servic	SOUTH AFRICAN COAL
6	1-May-14	7805	TLJ-856	52110	52.110	3827	199,424.97	Jick Way Transport Servic	SOUTH AFRICAN COAL

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37	23-May-14	8188	TLL-617	54390	54.390	3827	208,150.53	Jick Way Transport Servic	SOUTH AFRICAN COAL
38	23-May-14	8189	TLQ-916	51570	51.570	3827	197,358.39	Jick Way Transport Servic	SOUTH AFRICAN COAL
39	23-May-14	8190	TLW-784	54550	54.550	3827	208,762.85	Jick Way Transport Servic	SOUTH AFRICAN COAL
40	23-May-14	8191	TLW-947	54660	54.660	3827	209,183.82	Jick Way Transport Servic	SOUTH AFRICAN COAL
41	23-May-14	8192	TLH-397	52310	52.310	3827	200,190.37	Jick Way Transport Servic	SOUTH AFRICAN COAL
42	23-May-14	8193	TLL-913	51840	51.840	3827	198,391.68	Jick Way Transport Servic	SOUTH AFRICAN COAL
43	23-May-14	8194	TLN-747	52210	52.210	3827	199,807.67	Jick Way Transport Servic	SOUTH AFRICAN COAL
44	23-May-14	8195	TLZ-696	50830	50.830	3827	194,526.41	Jick Way Transport Servic	SOUTH AFRICAN COAL
1	24-May-14	8196	TLM-384	52920	52.920	3827	202,524.84	Jick Way Transport Servic	SOUTH AFRICAN COAL
2	24-May-14	8197	TLG-475	53890	53.890	3827	206,237.03	Jick Way Transport Servic	SOUTH AFRICAN COAL
3	24-May-14	8198	TLQ-179	51540	51.540	3827	197,243.58	Jick Way Transport Servic	SOUTH AFRICAN COAL
4	24-May-14	8199	TLL-674	53270	53.270	3827	203,864.29	Jick Way Transport Servic	SOUTH AFRICAN COAL
5	24-May-14	8200	MNW-9221	32530	32.530	3827	124,492.31	Jick Way Transport Servic	SOUTH AFRICAN COAL
6	24-May-14	8201	TLN-247	51370	51.370	3827	196,592.99	Jick Way Transport Servic	SOUTH AFRICAN COAL
7	24-May-14	8202	TLM-921	53100	53.100	3827	203,213.70	Jick Way Transport Servic	SOUTH AFRICAN COAL
8	24-May-14	8203	TLA-740	55480	55.480	3827	212,321.96	Jick Way Transport Servic	SOUTH AFRICAN COAL
9	24-May-14	8204	TLE-714	55520	55.520	3827	212,475.04	Jick Way Transport Servic	SOUTH AFRICAN COAL
10	24-May-14	8205	TLB-059	56660	56.660	3827	216,837.82	Jick Way Transport Servic	SOUTH AFRICAN COAL
11	24-May-14	8206	TLN-571	52450	52.450	3827	200,726.15	Jick Way Transport Servic	SOUTH AFRICAN COAL
12	24-May-14	8207	TLN-671	51750	51.750	3827	198,047.25	Jick Way Transport Servic	SOUTH AFRICAN COAL
13	24-May-14	8208	TLE-970	54990	54.990	3827	210,446.73	Jick Way Transport Servic	SOUTH AFRICAN COAL
14	24-May-14	8209	TLA-833	53980	53.980	3827	206,581.46	Jick Way Transport Servic	SOUTH AFRICAN COAL
15	24-May-14	8210	TLB-217	55370	55.370	3827	211,900.99	Jick Way Transport Servic	SOUTH AFRICAN COAL
16	24-May-14	8211	TLJ-506	53900	53.900	3827	206,275.30	Jick Way Transport Servic	SOUTH AFRICAN COAL
17	24-May-14	8212	TLN-415	53480	53.480	3827	204,667.96	Jick Way Transport Servic	SOUTH AFRICAN COAL
18	24-May-14	8213	TLW-007	55030	55.030	3827	210,599.81	Jick Way Transport Servic	SOUTH AFRICAN COAL
19	24-May-14	8214	TLH-886	53580	53.580	3827	205,050.66	Jick Way Transport Servic	SOUTH AFRICAN COAL
20	24-May-14	8215	TLG-962	54200	54.200	3827	207,423.40	Jick Way Transport Servic	SOUTH AFRICAN COAL
<b>TOTAL LIFTED WEIGHT</b>					<b>22987.080</b>				

**Figure 43: Currently Recoded Data for Transportation of Coal Via Truck (Road)<sup>2</sup>**

<sup>2</sup> Figure 43 contains the sample of data. The complete data is not present in this report

#### 6.2.4. Explanation of Currently Recorded Data for Truck

The description of data present in Figure 43 is explained in Table 19

**Table 19: Description of Currently Recorded Data for Transportation of Coal Via Truck**

S.NO.	Currently Recorded Data	Explanation
1.	Vessel Name	It is the name of ship which brought in the under-consideration coal
2.	Clearing Agent	The employee working at the time of under-consideration coal was dispatched
3.	Loading Point	The location from which the coal was loaded on the truck. It can be either the port or the warehouse (Garoni Yard)
4.	Destination	It is the location at which the under-consideration coal truck will drop the coal. It can be either warehouse or the plant (KMLG Plant Daud Khel)
5.	Bilty No.	It is the identification number of bills that has been generated when the coal was loaded on the truck
6.	Vehicle No.	It is the identification number of vehicle (truck)
7.	Weight in MT	It is the weight of coal in metric ton.
8.	Freight	It is the charges of coal transportation
9.	Bilty Name	It is the name of the bill that has been generated with Bilty No, when the coal was loaded on the truck.
10.	Coal Category	It is the type of coal that has been brought in by the ship
11.	Rate pmt	It is the rates of coal per metric ton.

After understanding the requirements within logistics process and analyzing the currently recorded data for both routes i.e. via railway carriage and via road we can move on towards the design of the software.

#### 6.3. Design of the Software

After the clear understanding of logistics process along with the requirements from software now we move towards the design of software. In section 1.2 the problems associated with the current logistics process were addressed and in section 1.3 the aim and scope of this project were concluded.

Let us now see how aim and scope of this project is solving the associated problems and what modules of software will be required to cater the problems.

The Table 20 depicts the relationship between the problems and aims and scope of the project

**Table 20: Problems Catered by Aim and Scope of Project**

S.NO.	Aim and Scope of the Project	Problems Catered
1.	Inventory management of raw material	<ul style="list-style-type: none"> <li>• Huge amount of duty</li> <li>• No means of backtracking coal</li> </ul>
2.	Feedback oriented software	<ul style="list-style-type: none"> <li>• Lose track of coal</li> <li>• No transportation schedule available</li> </ul>
3.	Business intelligence module for incoming and outgoing of raw material	<ul style="list-style-type: none"> <li>• No means of forecasting or making a strategic decision.</li> </ul>
4.	Monthly report generation	<ul style="list-style-type: none"> <li>• No automated report generation</li> </ul>
5.	Scheduling of coal transportation	<ul style="list-style-type: none"> <li>• No scheduled leads to huge amount of duty</li> </ul>
6.	3-pathway tracking	<ul style="list-style-type: none"> <li>• Wrong deliveries</li> <li>• No backtracking of coal</li> <li>• No means of tracking each batch</li> </ul>
7.	Financial management of raw material	<ul style="list-style-type: none"> <li>• Huge amount of duty</li> <li>• Consequences of wrong deliveries</li> </ul>

After analyzing the relationship between problems and aim and scope we can decide how many modules are needed to be designed in software.

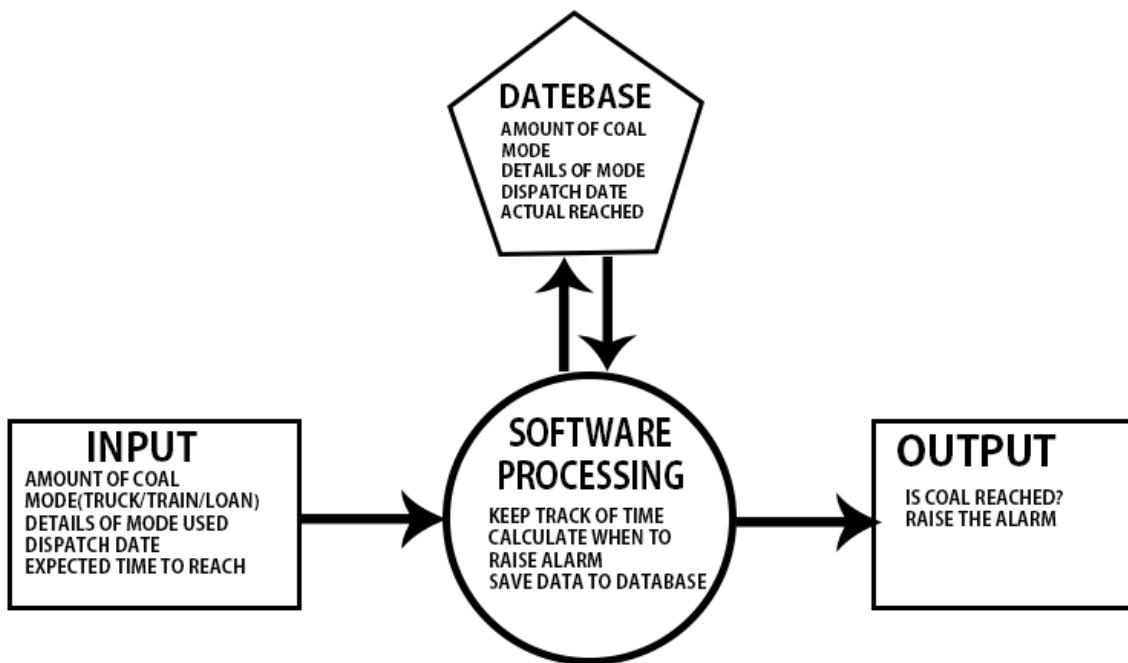
### **6.3.1. Modules in the Software**

Considering the requirements from Table 20 we decided that three modules will able to cater all problems. The following are the three modules

- I. Three-pathway tracking of raw material
- II. Transportation Schedule
- III. Automated report generation

#### **6.3.1.1. Three-pathway tracking of raw material**

The raw material, which is coal, is required to be transported from Muhammad Bin Qasim port to cement manufacturing plant at Daud Khel. There are two modes used for transportation of coal. Which are needed to be tracked. The third pathway is Loan. When company is unable to pick the coal at the given duration, then they lent it to another company, which they will get back later on. The logic used behind the three-pathway tracking of coal is as depicted in Figure 44

**Figure 44: Logic Behind Three-Pathway Tracking of Raw Material**

The data entered by the user as mentioned in section 6.1 will be used as input and saved in database. Every time, a batch of coal is transported the respective details will be entered in the software, and software will start keeping the track of that batch using the identification number, amount of coal and dispatch date. The pending order and completed order will be shown in the dashboard of the software. Software will have a default expected duration for transportation which will be used to check either the coal has reached on its destination or not. If the coal is late for reaching on its destination then an alarm will be raised.

#### **6.3.1.1.1. Inputs for the 3-Pathway Module**

During pathway tracking, specific details are needed to be saved within the software. The details of each mode of transportation differ from each other. It has many factors, up to 27, which are needed to be tracked and taken care for. These factors are behaving as inputs in scheduling, report generation etc. These variables are entered during data entry phase and later stored in database. The industry asked these factors to be input. The Figure 45 enlists the inputs.

Loading Date
Loading Point
Loading Quality
Loading Vessel
Wagon Number
RR Number
RR Date
Invoice #
Loaded Wagon Weight
Dispatch Date
Over Weight Status
Transhipment Status
If tranship , new wagon number
DKL #
Wagons in DKL
Weight of All Wagons in DKL
Single or Multiple Quality in 1 Wagon
Guard Name DKL
Guard Mobile Number DKL
Wrong Loading
Chargeable Freight
Freight
Rate
LMC
LHC
Overload
Frieght

*Figure 45: Inputs for 3-Pathway Tracking Module*

#### 6.3.1.2. Transportation Scheduling

The logistics process defined in section [2] is scheduled according to Axle load and Time to pick up the cargo before increased duty. Following inputs would be required from the user:

1. Cost of transportation in PKR/tons. ( $P_T$ )
2. Total amount of coal on the shipment in tons. (C)
3. Axle load in tons. (AL)
4. Duty in PKR/ton. (D)
5. Time to pick up the cargo in days. (T)

The method is used to calculate the follows:

1. Amount of duty to be paid (per day) in PKR. ( $D_s$ )
2. Amount of coal to be transported (per day) in tons. ( $C_D$ )
3. Freight cost in PKR. (F)
4. Number of trucks needed (per day). ( $T_D$ )

The calculations used in the method are as follows:

$$C_D = C / T$$

$$T_D = \text{ceiling}(C_D / AL)$$

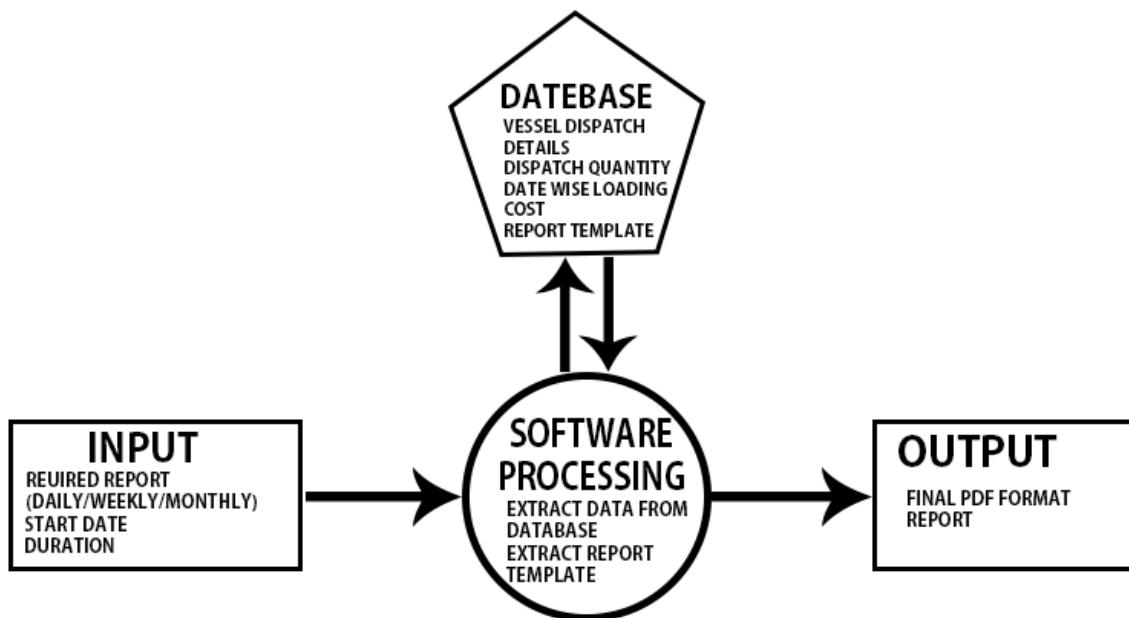
$$D_s = C_D \times D$$

$$F = P_T \times T_D$$

In software, a schedule will be made automatically made, after user input the date of arrival of coal on the port with amount in ton.

#### 6.3.1.3. Monthly/Weekly/Daily Report generation

The report generation is another module required in the software. This report can be generated for every duration. It is decided to provide ease to the company, so that they may have an option of creating bi-monthly reports if needed. The inputs in report generation module are only the duration and type of report needed, whereas the software will process the report variables which will be stored in database from the time of data entry and then software will provide a .pdf format of report as output. The logic behind this module is depicted in Figure 46.



**Figure 46: Logic Behind the Automated Report Generation Module**

In this module the inputs indicated in Figure 47 will be taken from the database when user asked software to create the report. The output will be a .pdf format as mentioned before.

### System Generated Reports

- Vessel Dispatch Record
- Dispatch Quantity
- Date wise loading record
- Station / RR wise loading record
- Costing Related to Freight
- Costing Related to Other payments
- Dispatch Record Monthwise
- Dispatch Record Stationwise

**Figure 47: Report Generation Module Input Extracted from Database**

Currently the report appears as,

**MAPLE LEAF CEMENT FACTORY LTD**

**COAL RACK LOADING AND DISPATCH REPORT**

(I Kan Sembok)

Vessel Name	Vessel Date	Via	Vehical No.	Load Qty (M.tons)	Total Loaded Wagons	Loading Date	Departure Date	Despatch Qty (M.Tons)	Despatch Wagon No.	Balance Qty (M.Tons)	Balance Wagon No.	Remarks
I KAN SEMBOK	09.05.2014	Train	IKS-1 / DKL 109	1,335.30	23	9-May-14	21-May-14	634.70	11	700.60	12	MLCF
I KAN SEMBOK	09.05.2014	Train	IKS-2/DKL 112	1,359.00	23	10-May-14	29-May-14	59.30	1	2,000.30	22	MLCF
I KAN SEMBOK	09.05.2014	Train	IKS-3/DKL 113	1,355.30	23	12-May-14	30-May-14	886.00	15	2,469.60	8	MLCF
I KAN SEMBOK	09.05.2014	Train	IKS-4/DKL 114	1,355.20	23	13-May-14	3-Jun-14	1,412.70	24	2,412.10	(1)	MLCF
I KAN SEMBOK	09.05.2014	Train	IKS-5/DKL 116	1,350.20	23	14-May-14	9-Jun-14	884.80	15	2,877.50	8	MLCF
I KAN SEMBOK	09.05.2014	Train	IKS-6/DKL 117	.	.	.	10-Jun-14	820.00	14	.	.	MLCF
I KAN SEMBOK	09.05.2014	Train	IKS-7/DKL 118	.	.	.	11-Jun-14	56.60	1	.	.	MLCF
I KAN SEMBOK	09.05.2014	Train	IKS-8/DKL 115	.	.	.	5-Jun-14	57.40	1	.	.	MLCF
I KAN SEMBOK	09.05.2014	Train	IKS-9/DKL 119	.	.	.	17-Jun-14	702.70	12	.	.	
I KAN SEMBOK	09.05.2014	Train	IKS-10/DKL 120	.	.	.	17-Jun-14	1,240.80	21	.	.	
			TOTAL	6,755.00	115			6,755.00	115	-	-	

**Figure 48: Current Report of Logistics Process**

SUMMARY	
TOTAL VESSEL M.TON	30,000.00
BY TRAIN	6,755.00
BY ROAD	22,987.080
TOTAL DISPATCH	29,742.08
TOTAL	257.92

**Figure 49: Summary of Current Report**

After designing the software, we can move towards how the testing and debugging of software will be done.

#### **6.4. Testing and Debugging of Software**

The next stage after programming the software is testing. In this stage the complete software is tested to identify possible errors, bugs, problems, and weak areas of coding. It is to provide the company with an error-free software. During testing phase, the bugs will be removed and the problems will be fixed and coding will be made efficient. This testing phase will be carried out by team members in order to make it

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

error-proof for the company. After improvement, the software will be tested again and this cycle will continue till an efficient and error free software is achieved.

The failure mode and effect analysis are carried out to identify all possible failure modes for our software. The FMEA in Table 23, was the guideline to debugged the software make sure that company will get an error-free and fully tested software.

### 6.4.1. Failure Mode and Effect Analysis

We conducted a failure mode and effect analysis to find out the potential failure modes for our project and their correction methods. The steps that we followed for FMEA are;

- I. Listing the critical steps in project
- II. Finding potential failure modes for each step of the project.
- III. Finding the causes of potential failure modes.
- IV. The possible effects of failures on our project.
- V. Recognize the actions required to avoid the failure from happening.

*Table 21: Impact Rating for FMEA*

RATING	SEVERITY OF EFFECT	LIKELIHOOD	CHANCES OF DETECTION
1	None	Not likely	Very Extreme
2	Below Minor	Relatively low failures	Extreme
3	Minor	Relatively low failures	Very High
4	Very Low	Occasional Failures	High
5	Low	Occasional Failures	Moderate
6	Moderate	Occasional Failures	Low
7	High	Repeated Failures	Very low
8	Very High	Repeated Failures	Minor
9	Extreme	Almost inevitable	Very Minor
10	Very Extreme	Inevitable Failure	Can't be detected

*Table 22: Risk Priority Number*

RPN	IMPORTANCE
5 – 49	Negligible
50 – 124	Acceptable
125 – 174	Permissible

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

175 – 224	Unacceptable
225 and higher	Intolerable

**Table 23: Failure Mode and Effect Analysis with Actions Recommended**

Area of Project	Potential Failure Mode	Potential Effect(s) of Failure Mode	Severity	Potential Cause	Occurrence	Current Controls	Detection	RPN	Actions Recommended
ERP Modules	Users Untrained	Implementation will not be effective as expected.	7	No Adequate Training Provided.	6	User Manual and Training. User Manual	5	210	Provide Interactive User Manual and Training.
	Unexpected Interference of Modules.		6	Software not Used properly	6		4	144	
	No or Minimum Consultancy		6	Non-Interactive User Manual	6		5	180	
Internet	Poor Connectivity.	Failure in Data Sharing and Transfer.	6	Problem with Service Provider.	5	Work will be offline	2	60	Update the Database Automatically When Connection Is Back.
Database	Misbehaving Database.	Crashing of Database.	8	Poor Coding.	3	Data Backup.	3	72	Automatic Data Recovery
	Misbehaving Database.	Inaccurate Data Entry.	8	Inattentiveness of User	6		5	240	Poka-Yoke.
Server	Failed Connection.	Data Sharing Not Possible.	4	Slow or No Internet Connection. Service Provider No More Available.	8	Try to Reconnect.	2	64	Provide Alternative Server.
Integration Platform	System fails to handle the software	Software will stop working	8	Resistance to adopting change	6	No detection	8	384	Provide interactive employee training
	Code Changed by someone		9	Un-authorized user interference	3		8	216	Secure/lock code
	Un-authorized user interference		7	Lack of security	5		8	280	User control

## **6.5. Implementation of Software**

The first step towards the implementation of system is to get implementation approval by company. After the software is approved the following steps will be followed.

### **6.5.1. Installation of System**

We will be required to install the system in company's computer. All program files will be transferred to the hosting server and a domain name will be the required server will be installed. Later the verification will take place, i.e. if software is running as it should.

### **6.5.2. Employee Training**

When the software is successfully installed and all the required data is fed and is finally ready to use, the next step will be of training and helping the employees on how to use the software properly and efficiently. A user manual will also be provided to the employees for guidance. They will be also trained for how to deal with software when it malfunctions or shows errors.

### **6.5.3. Analyzation of Results**

The last step is to analyze the efficiency and improvement provided by the new system. It will help us to measure the potential of the new system and room for further improvements can also be identified. We will compare the results with the initial problem description so that, it can be identified whether the new system has solved these problems or not and if yes, then to what extent.

## **7. DEVELOPMENT OF SOFTWARE**

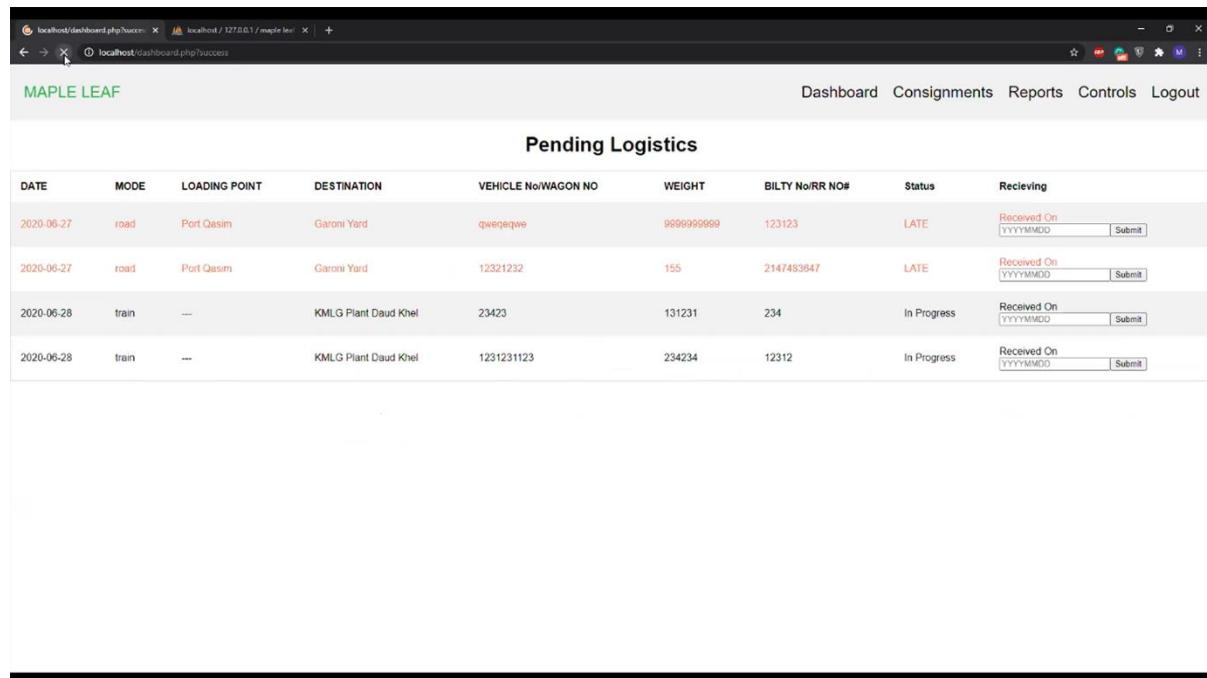
In section 6.3], the design of software was discussed. Keeping in mind the user experience design and security importance with-in system the web application contains the following module tabs.

- I. Dashboard
- II. Consignment
- III. Report
- IV. Controls
- V. Logout

### **7.1. Dashboard**

Dashboard is the type of graphical user interface which provides at-a-glance views of key performance indicators relevant to a particular objective. In this software, the dashboard provides the at-a-glance view of current status of all dispatches, either via train or truck along with its loading point, destination point, dispatch date, weight and some other identification details.

The Figure 50 shows the dashboard of our software.



The screenshot shows a web browser window with two tabs open: 'localhost/dashboard.php?success' and 'localhost / 127.0.0.1 / maple leaf'. The main content area is titled 'MAPLE LEAF' and features a navigation bar with links for 'Dashboard', 'Consignments', 'Reports', 'Controls', and 'Logout'. Below this is a section titled 'Pending Logistics' containing a table with four rows of data. The columns are labeled: DATE, MODE, LOADING POINT, DESTINATION, VEHICLE No/WAGON NO, WEIGHT, BILL No/RR NO#, Status, and Recieving. The data is as follows:

DATE	MODE	LOADING POINT	DESTINATION	VEHICLE No/WAGON NO	WEIGHT	BILL No/RR NO#	Status	Recieving
2020-06-27	road	Port Qasim	Garoni Yard	qweeqwew	9999999999	123123	LATE	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-27	road	Port Qasim	Garoni Yard	12321232	155	2147483647	LATE	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-28	train	---	KMLG Plant Daud Khel	23423	131231	234	In Progress	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-28	train	---	KMLG Plant Daud Khel	1231231123	234234	12312	In Progress	Received On [YYYYMMDD] <input type="button" value="Submit"/>

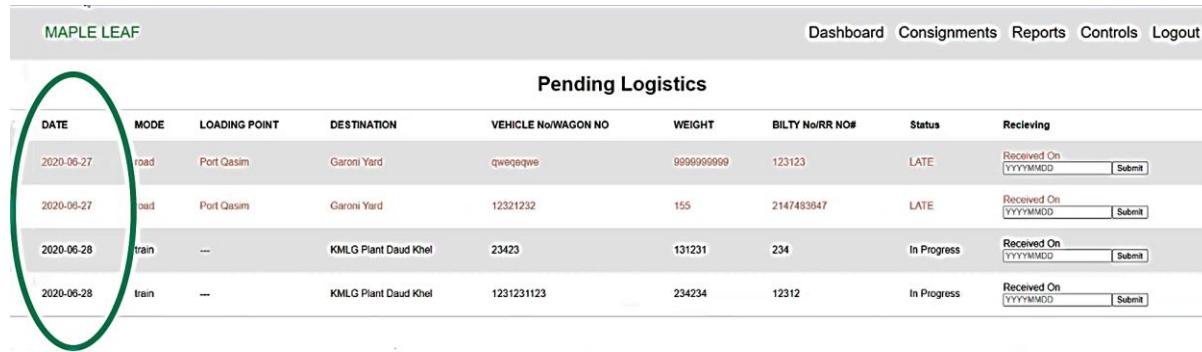
**Figure 50: Dashboard of Web Application**

The dashboard indicates the following:

#### **7.1.1. Date**

Date indicates, when the following dispatch started.

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

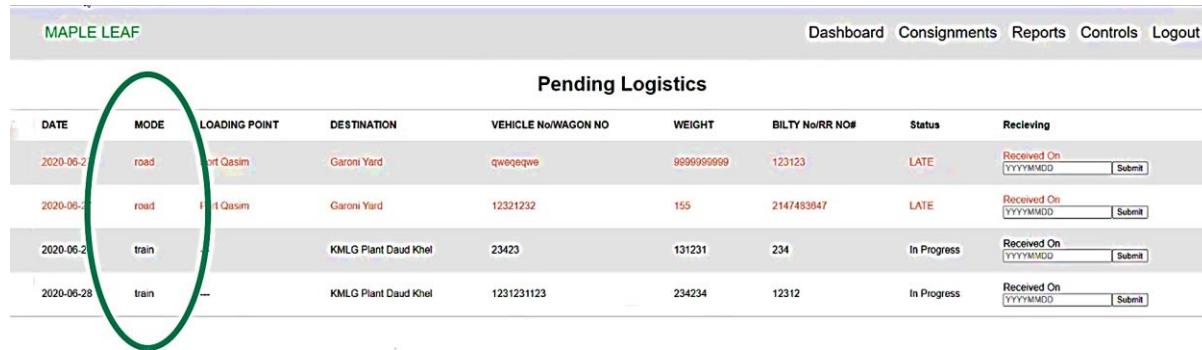


Pending Logistics								
DATE	MODE	LOADING POINT	DESTINATION	VEHICLE No/WAGON NO	WEIGHT	BILTY No/RR NO#	Status	Receiving
2020-06-27	road	Port Qasim	Garoni Yard	qwesqeque	9999999999	123123	LATE	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-27	road	Port Qasim	Garoni Yard	12321232	155	2147483647	LATE	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-28	train	--	KMLG Plant Daud Khel	23423	131231	234	In Progress	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-28	train	--	KMLG Plant Daud Khel	1231231123	234234	12312	In Progress	Received On [YYYYMMDD] <input type="button" value="Submit"/>

**Figure 51: Dashboard - Date**

### 7.1.2. Mode

Mode indicates whether the dispatch has occurred via train or truck.

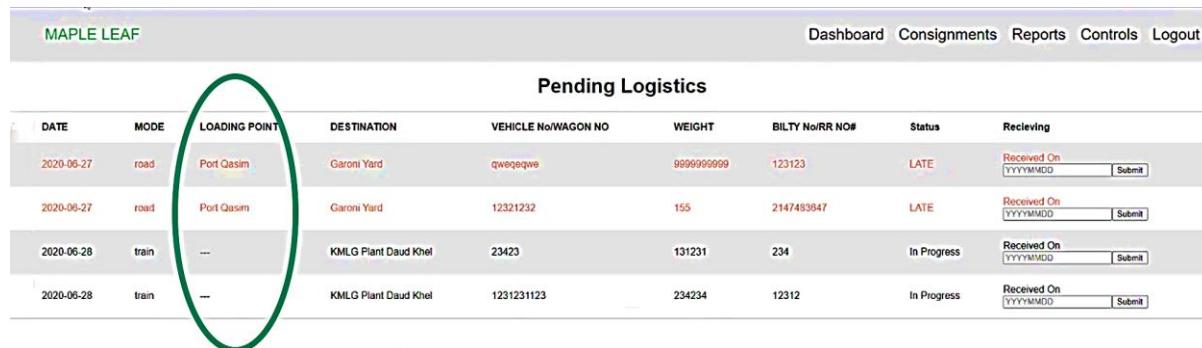


Pending Logistics								
DATE	MODE	LOADING POINT	DESTINATION	VEHICLE No/WAGON NO	WEIGHT	BILTY No/RR NO#	Status	Receiving
2020-06-27	road	Port Qasim	Garoni Yard	qwesqeque	9999999999	123123	LATE	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-27	road	Port Qasim	Garoni Yard	12321232	155	2147483647	LATE	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-28	train	--	KMLG Plant Daud Khel	23423	131231	234	In Progress	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-28	train	--	KMLG Plant Daud Khel	1231231123	234234	12312	In Progress	Received On [YYYYMMDD] <input type="button" value="Submit"/>

**Figure 52: Dashboard - Mode**

### 7.1.3. Loading Point

The loading point can either be Port Muhammad Bin Qasim or warehouse for truck while, it can only be warehouse for dispatch of coal via train. The Garoni Yard is the warehouse of coal.



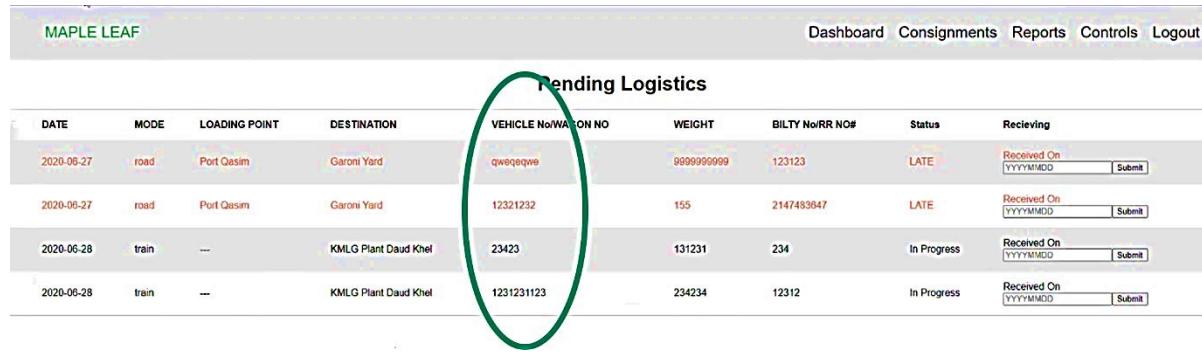
Pending Logistics								
DATE	MODE	LOADING POINT	DESTINATION	VEHICLE No/WAGON NO	WEIGHT	BILTY No/RR NO#	Status	Receiving
2020-06-27	road	Port Qasim	Garoni Yard	qwesqeque	9999999999	123123	LATE	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-27	road	Port Qasim	Garoni Yard	12321232	155	2147483647	LATE	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-28	train	--	KMLG Plant Daud Khel	23423	131231	234	In Progress	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-28	train	--	KMLG Plant Daud Khel	1231231123	234234	12312	In Progress	Received On [YYYYMMDD] <input type="button" value="Submit"/>

**Figure 53: Dashboard - Loading Point**

### 7.1.4. Vehicle No./Wagon No.

It is the identification number of truck (Vehicle No.) or train carriage (Wagon No.).

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

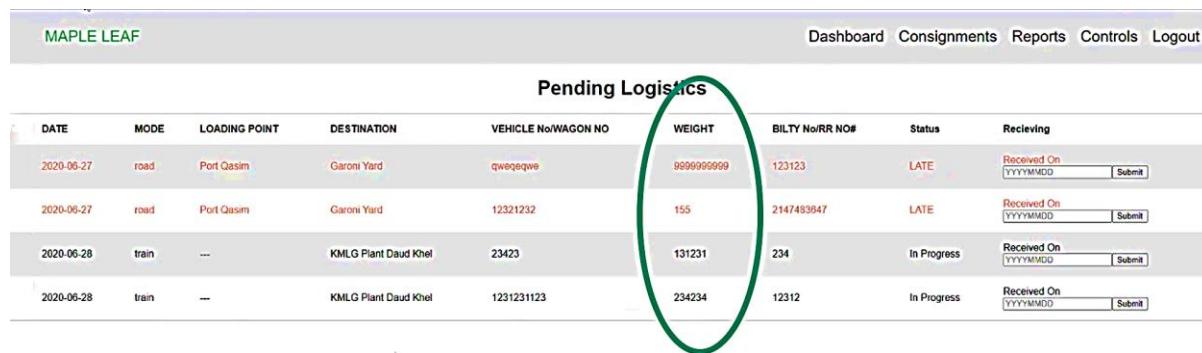


DATE	MODE	LOADING POINT	DESTINATION	VEHICLE No/WAGON NO	WEIGHT	BILTY No/RR NO#	Status	Receiving
2020-06-27	road	Port Qasim	Garoni Yard	qweqeque	999999999	123123	LATE	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-27	road	Port Qasim	Garoni Yard	12321232	155	2147483647	LATE	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-28	train	--	KMLG Plant Daud Khel	23423	131231	234	In Progress	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-28	train	--	KMLG Plant Daud Khel	1231231123	234234	12312	In Progress	Received On [YYYYMMDD] <input type="button" value="Submit"/>

**Figure 54 Dashboard - Vehicle Number**

### 7.1.5. Weight

It indicates the weight of coal in the under-consideration dispatch.

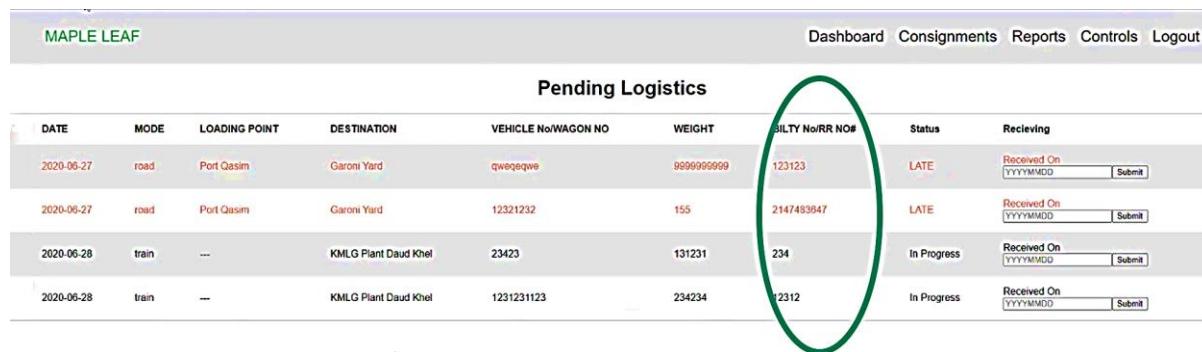


DATE	MODE	LOADING POINT	DESTINATION	VEHICLE No/WAGON NO	WEIGHT	BILTY No/RR NO#	Status	Receiving
2020-06-27	road	Port Qasim	Garoni Yard	qweqeque	999999999	123123	LATE	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-27	road	Port Qasim	Garoni Yard	12321232	155	2147483647	LATE	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-28	train	--	KMLG Plant Daud Khel	23423	131231	234	In Progress	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-28	train	--	KMLG Plant Daud Khel	1231231123	234234	12312	In Progress	Received On [YYYYMMDD] <input type="button" value="Submit"/>

**Figure 55: Dashboard - Weight**

### 7.1.6. Bilty No.

It is the receipt number.



DATE	MODE	LOADING POINT	DESTINATION	VEHICLE No/WAGON NO	WEIGHT	BILTY No/RR NO#	Status	Receiving
2020-06-27	road	Port Qasim	Garoni Yard	qweqeque	999999999	123123	LATE	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-27	road	Port Qasim	Garoni Yard	12321232	155	2147483647	LATE	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-28	train	--	KMLG Plant Daud Khel	23423	131231	234	In Progress	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-28	train	--	KMLG Plant Daud Khel	1231231123	234234	12312	In Progress	Received On [YYYYMMDD] <input type="button" value="Submit"/>

**Figure 56: Dashboard – Bilty Number**

### 7.1.7. Status

It shows whether the dispatch is currently in progress, late or delivered. The Figure 57 shows that a dispatch via truck, whose loading point was Port Qasim and was dispatched on 27/06/2020 is late to reach its destination.

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

Pending Logistics								
DATE	MODE	LOADING POINT	DESTINATION	VEHICLE No/WAGON NO	WEIGHT	BILTY No/RR NO#	Status	Receiving
2020-06-27	road	Port Qasim	Garoni Yard	qweqeque	999999999	123123	LATE	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-27	road	Port Qasim	Garoni Yard	12321232	155	2147483647	LATE	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-28	train	---	KMLG Plant Daud Khel	23423	131231	234	In Progress	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-28	train	---	KMLG Plant Daud Khel	1231231123	234234	12312	In Progress	Received On [YYYYMMDD] <input type="button" value="Submit"/>

**Figure 57: Dashboard - Late**

### 7.1.8. Received

If the coal has been reached on plant/warehouse, the user will enter the date it was received and the status will change to “delivered”

Pending Logistics								
DATE	MODE	LOADING POINT	DESTINATION	VEHICLE No/WAGON NO	WEIGHT	BILTY No/RR NO#	Status	Receiving
2020-06-27	road	Port Qasim	Garoni Yard	qweqeque	999999999	123123	LATE	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-27	road	Port Qasim	Garoni Yard	12321232	155	2147483647	LATE	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-28	train	---	KMLG Plant Daud Khel	23423	131231	234	In Progress	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-28	train	---	KMLG Plant Daud Khel	1231231123	234234	12312	In Progress	Received On [YYYYMMDD] <input type="button" value="Submit"/>

**Figure 58: Dashboard - Received**

## 7.2. Consignment

Consignment is the second tab in our software. Its purpose is to record the details of each transportation. By clicking on “consignment” the page shown in Figure 59 will open. It has following sub-tabs

- I. By Ship
- II. By Road
- III. By Train
- IV. Create Rake

By Ship								
By Road								
By Train								
Create Rake								

**Figure 59: Consignment Tab in Web Application**

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

### 7.2.1. By Ship

By clicking on this option, the page shown in Figure 60 will open. In this tab the data of incoming vessel will be entered and data will be recorded in database mention in section 9.1.1.2] also shown at the bottom of tab in tabulated form.

VESSEL NAME	WEIGHT (M.T)	RECEIVING DATE	COAL CATEGORY	
areeb1	1000	2020-06-29	southafricanccal	<a href="#">delete</a>
areeb	1000	2020-06-29	southafricanccal	<a href="#">delete</a>
231231	21391	2020-05-06	231233232323	<a href="#">delete</a>
1233	812	2020-04-29	1342	<a href="#">delete</a>
adifadsf	0	2020-04-29	adifaf	<a href="#">delete</a>
12312	0	2020-05-20	12313	<a href="#">delete</a>

Figure 60: By Ship - Sub Tab in Web Application

By ship sub-tab has following indicators

- I. Vessel Name
- II. Weight (M.T)
- III. Receiving Date
- IV. Coal Category

their purpose is defined in Table 24:

Table 24: Purpose of Indicators in By Ship Sub-Tab

S.NO.	Indicators	Purpose
I.	Vessel Name	It is the name of ship from which the coal is shipped-in in the country.
II.	Weight (M.T)	It is the amount of coal in metric ton that has been shipped-in This amount will be used to generate the Schedule.
III.	Receiving Date	It is the date at which the ship unloaded the coal on port. This date will be used as starting date for schedule.
IV.	Coal Category	It is the type of coal that has been shipped-in.

We made sure that no duplicate entry is permitted, hence every time a duplicate entry is submitted the data will not add in database mention in section 9.1.1.2] and following notification will be shown

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

Error: INSERT INTO ship (shipname, amountofcoal, recievingdate, CoalCategory) VALUES ('areeb', 1000, 20200629, 'southafricanccal')  
Duplicate entry 'areeb-2020-06-29' for key 'avoidduplicatc'

Figure 61: Duplicate Entry is Not Permitted

### 7.2.2. By Road

It is the second sun-tab provided in consignment tab in our software. By clicking on this option, the page shown in Figure 62. In this sub tab the data regarding the dispatch of coal via truck will be input by user and will automatically be saved in the database mention in section [9.1.1.3]. The data saved in database mention in section [9.1.1.3] is also shown at the bottom of page in tabulated form.

Loading Date	Bilty Number	Weight (M.T.)	Vehicle Number	Rate(per M.T.)	Freight	Bilty Name	Coal Category	Vessel Name	Clearing Agent	Loading Point	Destination	Taken from Ship	Delete
2020-06-27	2147483647	155	12321232	12323	1910065	asdasda 09:56 dfasdf	231233232323	231231	asdasd	Port Qasim	Garoni Yard	No	<a href="#">delete</a>
2020-06-27	123123	9999999999	qwqqeqwe	1313123	2147483647	231233232323	231231	adsfa	Port Qasim	Garoni Yard	No	<a href="#">delete</a>	

Figure 62: By Road - Sub-Tab in Web Application

This sub-tab has the following indicators

- I. Clearing Agent
- II. Bilty Name
- III. Bilty Number
- IV. Loading Date
- V. Vehicle Number
- VI. Weight
- VII. Rate
- VIII. Loading Point
- IX. Destination
- X. Vessel Name

The purpose of these indicators is explained in Table 25:

**Table 25: Purpose of Indicators in By Road Sub-Tab**

S.NO.	Indicators	Purpose
I.	Clearing Agent	
II.	Bility Name	
III.	Bility Number	
IV.	Loading Date	
V.	Vehicle Number	
VI.	Weight	
VII.	Rate	
VIII.	Loading Point	
IX.	Destination	
X.	Vessel Name	

#### **7.2.2.1. Subtraction of Amount of Coal from Vessel**

In here, a check box is provided named “subtract amount of coal from shipment”, depicted in Figure 63

The screenshot shows a form with the following fields:

- Vehicle Number: [Input Field]
- Weight (M.T.): [Input Field]
- Rate (per M.T.): [Input Field]
- Loading Point: Port Qasim [Dropdown]
- Destination: Garoni Yard [Dropdown]
- Vessel Name: 231231-2020-05-06 [Input Field]  subtract amount of coal from shipment [Check Box]
- Submit [Button]

**Figure 63: Subtraction of Amount of Coal from Vessel**

The purpose of this checkbox is that, every time coal is dispatched via truck, it is not necessary that coal is picked from port. So, user is required to check the box every time the loading point is selected as Port Qasim.

#### **7.2.2.2. Error Proofing for limited amount of coal**

In each vessel, a certain amount of coal is present. And every time the user checks the box mentioned in section [7.2.2.1] certain amount will be subtracted from initial amount of coal.

There can be a point when user enter more amount for transportation than it is present on the port (in the vessel).

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

	<a href="#">Edit</a>	<a href="#">Copy</a>	<a href="#">Delete</a>	<a href="#">id</a>	<a href="#">shipname</a>	<a href="#">amountofcoal</a>	<a href="#">receivingdate</a>	<a href="#">CoalCategory</a>	<a href="#">time</a>
<input type="checkbox"/>	<a href="#">Edit</a>	<a href="#">Copy</a>	<a href="#">Delete</a>	22	aareeb1	1000	2020-06-29	southafricanccal	2020-06-29 15:20:05
<input type="checkbox"/>	<a href="#">Edit</a>	<a href="#">Copy</a>	<a href="#">Delete</a>	20	aareeb	1000	2020-06-29	southafricanccal	2020-06-29 15:19:53
<input type="checkbox"/>	<a href="#">Edit</a>	<a href="#">Copy</a>	<a href="#">Delete</a>	6	231231	21391	2020-05-06	231233232323	2020-06-27 18:01:01
<input type="checkbox"/>	<a href="#">Edit</a>	<a href="#">Copy</a>	<a href="#">Delete</a>	9	1233	812	2020-04-29	1342	2020-06-27 18:01:01
<input type="checkbox"/>	<a href="#">Edit</a>	<a href="#">Copy</a>	<a href="#">Delete</a>	11	adfafsf	0	2020-04-29	adfaf	2020-06-27 18:01:01
<input type="checkbox"/>	<a href="#">Edit</a>	<a href="#">Copy</a>	<a href="#">Delete</a>	12	12312	0	2020-05-20	12313	2020-06-27 18:01:01

**Figure 64: Amount of Coal Present**

Currently, in vessel name “1233” amount of available coal is 812, as shown in Figure 64. Now, if user tried to enter the amount of coal “1000” as shown in Figure 65, this submission will not go through and a notification will appear as shown in Figure 66.

Loading Date:	Bill Number:	Weight (M.T):	Vehicle Number:	Rate(per M.T):	Freight:	Bill Name:	Coal Category:	Vessel Name:	Clearing Agent:	Loading Point:	Destination:	Taken from Ship:
2020-06-27	2147483647	155	12321232	12323	1910065	asdadsa	231233232323	231231	asdasd	Port Qasim	Garoni Yard	No
2020-06-27	123123	9999999999	qweqegeqwe	1313123	2147483647	dfasdl	231233232323	231231	adsfa	Port Qasim	Garoni Yard	No
2020-06-27	3112	210	414	1412	296520	13331	12313	12312	13133	Port Qasim	Garoni Yard	Yes

**Figure 65: Amount of Coal Entered More than Available Amount**

**Figure 66: Error Notification - Not Enough Coal**

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

### 7.2.3. By Train

This is the third sub-tab present in consignment tab. Its purpose is as same as the “By Road” sub-tab mentioned in section 7.2.2]. when clicked on this option, the page shown in Figure 67 will appear.

MAPLE LEAF
Dashboard Consignments Reports Controls Logout

Loading Date:	<input type="text" value="29-Jun-2020"/>
Railway Receipt Date:	<input type="text" value="29-Jun-2020"/>
Vessel Name:	<input type="text" value="231231-2020-05-06"/>
Railway Receipt Number:	<input type="text"/>
Invoice Number:	<input type="text"/>
Wagon Number:	<input type="text"/>
Weight (M.T):	<input type="text"/>
Charged (M.T):	<input type="text"/>
Freight (PKR):	<input type="text"/>
Duty Charged (PKR):	<input type="text"/>
25 Percent	<input type="text"/>
LHC (PKR):	<input type="text" value="0"/>
LMC (PKR):	<input type="text" value="0"/>
Over Load (M.T)	<input type="text" value="0"/>
Total Payment (PKR):	<input type="text" value="0"/>
Weighment Charges (PKR):	<input type="text" value="0"/>
Charged (M.T):	<input type="text"/>
Freight (PKR):	<input type="text"/>
Duty Charged (PKR):	<input type="text"/>
25 Percent	<input type="text"/>
LHC (PKR):	<input type="text" value="0"/>
LMC (PKR):	<input type="text" value="0"/>
Over Load (M.T)	<input type="text" value="0"/>
Total Payment (PKR):	<input type="text" value="0"/>
Weighment Charges (PKR):	<input type="text" value="0"/>
Siding	<input type="text"/>
Payment Date:	<input type="text" value="dd----yyyy"/>
<input type="button" value="Submit"/>	

RECORDED DATA

Railway Receipt Number	Invoice Number	Loading Date	Railway Receipt Date	Wagon Number	Weight (M.T)	Charged (M.T)	Freight (PKR)	LHC (PKR)	LMC (PKR)	Duty Charged (PKR)	Siding	25 Percent	Over Load (M.T)	Total Payment (PKR)	Weighment Charges (PKR)	Payment Date	Vessel Name	
12312	3123123	2020-06-28	2020-06-28	1231231123	234234	231231	3123	0	0	342	—	23123	0	0	0	0000-00-00	231231	<a href="#">delete</a>
234	234234	2020-06-28	2020-06-28	23423	131231	4234	3123	0	0	342	—	234	0	0	0	0000-00-00	231231	<a href="#">delete</a>

**Figure 67: By Train - Sub-Tab in Web Application**

In this sub tab the data regarding the dispatch of coal via train will be input by user and will automatically be saved in the database mention in section [9.1.1.4]. The data saved in database mention in section [9.1.1.4] is also shown at the bottom of page in tabulated form.

This sub-tab has the following indicators

- I. Loading Date
- II. Railway Receipt
- III. Vessel Name
- IV. Railway Receipt Number
- V. Invoice Number

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- VI. Wagon Number
- VII. Weight (M.T)
- VIII. Charged (M.T)
- IX. Freight
- X. Duty Charged
- XI. 25 Percent
- XII. LHC
- XIII. LMC
- XIV. Overload
- XV. Total Payment
- XVI. Weighment Charges
- XVII. Sliding
- XVIII. Payment Date

The purpose of these indicators is explained in Table 26:

***Table 26: Purpose of Indicators in By Train Sub-Tab***

S.NO.	Indicators	Purpose
I.	Loading Date	It is the date of loading of coal on wagon Same as dispatch date This date will be used as initial date to keep track of following coal dispatch
II.	Railway Receipt	It is the receipt provided by the Pakistan Railway. This date will be saved in database to keep record and will be used in report along with all other entries.
III.	Vessel Name	It is the name of ship in which the under-consideration coal came in. This date will be saved in database to keep record and will be used in report along with all other entries.
IV.	Railway Receipt Number	It is the identification number for railway receipt provided by railway Pakistan
V.	Invoice Number	It is again the identification number. This date will be saved in database to keep record and will be used in report along with all other entries.
VI.	Wagon Number	It is the carriage number of trains. This date will be saved in database to keep record and will be used in report along with all other entries.
VII.	Weight (M.T)	Amount of coal in metric ton. This date will be saved in database to keep record and will be used in report along with all other entries.
VIII.	Charged (M.T)	Charged amount of coal. This date will be saved in database to keep record and will be used in report along with all other entries.
IX.	Freight	This is the rate of coal transportation. This date will be saved in database to keep

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		record and will be used in report along with all other entries.
X.	Duty Charged	Duty charged by port on under consideration amount of coal.
XI.	25 Percent	25% of the Duty Charged
XII.	LHC	It is the charges of railway
XIII.	LMC	It is the charges of railway
XIV.	Overload	It is the extra amount of coal
XV.	Total Payment	This is the total charges. It will be calculated by software
XVI.	Weighment Charges	It is the charges of weighment
XVII.	Sliding	It is the station
XVIII.	Payment Date	The date on which the MLC has done the payment.

### 7.2.4. Create Rake

MLC, creates a rake number which would contain a certain number of wagons. It is basically the batch of wagons of train. It can be created by clicking on this sub-tab.

First the user has to enter the following

- I. Railway Rake Name
- II. Departure Date
- III. Loading Point
- IV. Vessel Name

RECORDED DATA				
Railway Rake:	Departure Date:	Loading Point:	Destination:	Number of Wagons:

**Figure 68: Step 1 - Creation of Rake**

After clicking submit the following page will appear.

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rmo	invno	lddate	rrdate	wagonno	weight	charged	freight	lhc	lmc	dutycharged	siding	25%	overload	totalpayment	w/m/entcharges	paymentdate	total
12312	3123123	2020-06-28	2020-06-28	1231231123	234234	231231	3123	0	0	342	---	23123	0	0	0	0000-00-00	3465
234	234234	2020-06-28	2020-06-28	23423	131231	4234	3123	0	0	342	---	234	0	0	0	0000-00-00	3465

**Figure 69: Step 2 - Creation of Rake**

Now user has to choose from the wagon option present (these options are available as they were entered in “By Train” sub-tab, as mentioned in section 7.2.3])

New Rake has been created and saved in database mention in section 9.1.1.5]

Railway Rake:	Departure Date:	Loading Point:	Destination:	Number of Wagons:	Action
david	2020-06-26	11223	KMLIS Plant (David Iroko)	2	Edit

**Figure 70: Step 3 - Rake Creation**

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### 7.3. Report

The third tab in the web application is report. On clicking on this option, the following page will open.

The screenshot shows the 'Vessel Report' section of the software. At the top, there is a search bar labeled 'Vessel Name' with the value '231231-2020-05-06' and a 'Submit' button. Below the search bar are four sub-tabs: 'REPORT', 'Average Schedule', 'Graphs', and 'Graphs' again. Each sub-tab has its own 'Submit' button. The background of the main area is light grey.

**Figure 71: Report Generation**

This tab has following sub-tabs

- I. Vessel Report
- II. Report
- III. Average Schedule
- IV. Graphs

#### 7.3.1. Vessel Report

This option permit user to create the report of complete coal of a single vessel. Enter the vessel name n slot below and click on submit. By doing this, a report will be generated which will look like the figure below

The screenshot shows the 'Coal Loading and Dispatch Report - By Vessel Name' section. At the top, it displays 'SHIP NAME: AREEB1234'. Below this is a table titled 'COAL RACK LOADING AND DISPATCH REPORT' with two rows of data. The first row shows 'ARFEB1234' with 'TRAIN' as the mode of transport, '123' as the rake number, and '2020-06-29' as the loading date. The second row shows 'ARFEB1234' with 'TRAIN' as the mode of transport, '1234' as the rake number, and '2020-06-29' as the loading date. To the right of the table is a 'SUMMARY (M.TON)' box containing the following data:  
TOTAL VESSEL: 1000  
BY TRAIN: 275595  
BY ROAD: 10  
TOTAL DISPATCH: 275595  
TOTAL REMAINING: 274595

Below the summary is a 'WAGON REPORT' table with three rows of data. The columns include S.NO, R.R #, INV.#, LOADING DATE, R.R DATE, WAGON NUMBER, WEIGHT, CHARGED, FREIGHT, LHC, LMC, DUTY CHARGED, SIDING, 25 PERCENT, OVERLOAD, TOTAL PAYMENT, PAYMENT DATE, WEIGHTIMENT CHARGE, and RAKE NO. The data shows wagon numbers 123, 1231, and 1234 with various weights and charges. To the right of the wagon report is a 'TRUCK REPORT' table with one row of data, showing a truck with vehicle number TKN-1 and weight 10.

**Figure 72: Coal Loading and Dispatch Report - By Vessel Name**

#### 7.3.2. Report

As it was required that software allows the user to create a daily, weekly and monthly report. We have provided this option.

By selecting the “from” and “to” date user can create report between whatever duration is required.

By clicking submit, the report which will be generated will look like the figure below

# MAPLE LEAF CEMENT FACTORY LTD

**LOGISTICS REPORT**  
**FROM:2020-06-01**  
**TO:2020-07-01**

## COAL RACK LOADING AND DISPATCH REPORT

VESSEL NAME	VESSEL DATE	VIA	RAKE NO	LOADING DATE	DEPARTURE DATE	DISPATCH QUANTITY(M.Tons)	NO OF WAGONS	WAGONS RECEIVED AT FACTORY	
231231	2020-05-06	TRAIN	15	2020-06-28	2020-06-29	234234	1	0	
AREEB1234	2020-06-29	TRAIN	1234	2020-06-29	2020-06-29	131231	1	0	
AREEB1234	2020-06-29	TRAIN	123	2020-06-29	2020-06-29	144354	2	0	
							509819	4	0

SUMMARY (MTON)
BY TRAIN: 772281
BY ROAD: 451919
TOTAL PROCESSED: 961738

## WAGON REPORT

S.NO	R.R #	INV.#	LOADING DATE	R.R DATE	WAGON NUMBER	WEIGHT	CHARGED	FREIGHT	LHC	LMC	DUTY CHARGED	SIDING	25 PERCENT	OVERLOAD	TOTAL	PAYMENT	PAYMENT DATE	WEIGHMENT CHARGE	RAKE NO
1	12312	3123123	2020-06-28	2020-06-28	1231231123	234234	231231	3123	0	0	342	---	23123	0	3465	0	0000-00-00	0	15
2	234	234234	2020-06-29	2020-06-29	23423	131231	4234	3123	0	0	342	0	0	0	3465	0	2020-06-24	0	1234
3	234	12312313	2020-06-29	2020-06-29	1231	13123	231231	31231	0	0	342	0	0	0	31573	0	2020-06-17	0	123
4	234	3123123	2020-06-29	2020-06-29	23423	131231	4234	3123	0	0	13	0	0	0	3136	0	2020-07-01	0	123
5	234	234234	2020-06-29	2020-06-29	23423	131231	4234	3123	0	0	342	0	0	0	3465	0	2020-06-09	0	
6	234	234234	2020-06-29	2020-06-29	23423	131231	4234	3123	0	0	342	0	0	0	3465	0	2020-07-01	0	
					772281										48569	0		0	

## TRUCK REPORT

Figure 73: Coal Loading and Dispatch Report - Date Wise 1

**TRUCK REPORT**

S.NO	LOADING DATE	BILTY NO	VEHICLE NO	WEIGHT (M.T)	RATE (per M.T)	FREIGHT	BILTY NAME	COAL CATEGORY	LOADING POINT	DESTINATION	CLEARING AGENT
1	2020-06-18	13131313	23131313231	3312	31233123	31331231	131	23123	313131	31313133	131331
2	2020-06-27	123121	615114	101	141	14241	3121	1342	Port Qasim	KMLG Plant Daud Khel	231231
3	2020-06-27	231	31231	4124	13123	54119252	31231	12313	Port Qasim	KMLG Plant Daud Khel	241412
4	2020-06-29	1	TKN-1	10	100	1000	AREB	SOUTHAF	Port Qasim	KMLG Plant Daud Khel	231231
5	2020-06-29	2	TLN-2	10	100	1000	AREB	231233232323	Port Qasim	Garoni Yard	123
6	2020-06-29	1313131	1313131	313131	1313	411141003	3121	231233232323	Port Qasim	KMLG Plant Daud Khel	231231
7	2020-06-30	123121	123265665	131231	9999999999	2147483647	3121	231233232323	Loan	Garoni Yard	231231
				451919		2644091374					

**LOAN REPORT**

**LOANED**

S.NO	LOADING DATE	BILTY NO	VEHICLE NO	WEIGHT (M.T)	RATE (per M.T)	FREIGHT	BILTY NAME	COAL CATEGORY	LOADING POINT	DESTINATION	CLEARING AGENT
1	2020-06-30	1234	12234	123	123	15129	3121	231233232323	Port Qasim	Loan	231231
				123							

**RETURNED**

S.NO	LOADING DATE	BILTY NO	VEHICLE NO	WEIGHT (M.T)	RATE (per M.T)	FREIGHT	BILTY NAME	COAL CATEGORY	LOADING POINT	DESTINATION	CLEARING AGENT
1	2020-06-30	123121	123265665	131231	9999999999	2147483647	3121	231233232323	Loan	Garoni Yard	231231
				131231							

**Figure 74: Coal Loading and Dispatch Report - Date Wise 2**

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### 7.3.3. Average Schedule

The third option in this tab is schedule. This allows the user to create the schedule for transportation of coal, available in specific vessel, via truck. In order to do so, the user is required to click on “schedule” button, the following page will open.



Figure 75: Schedule Generation - Step 1

The user is required to select the vessel name, enter the cost, axle load, duty paid (PKR/ton) and days to pick coal and click submit.

The schedule will be created and appear as depicted in figure below



29th Jun 2020, Monday	30th Jun 2020, Tuesday	1st Jul 2020, Wednesday	2nd Jul 2020, Thursday	3rd Jul 2020, Friday	4th Jul 2020, Saturday	5th Jul 2020, Sunday
Coal to be sent = 1426.07 tons Freight cost = 29000 PKR/- Amount of duty to be paid = 285214 PKR/- No. of Trucks = 29	Coal to be sent = 1426.07 tons Freight cost = 29000 PKR/- Amount of duty to be paid = 285214 PKR/- No. of Trucks = 29	Coal to be sent = 1426.07 tons Freight cost = 29000 PKR/- Amount of duty to be paid = 285214 PKR/- No. of Trucks = 29	Coal to be sent = 1426.07 tons Freight cost = 29000 PKR/- Amount of duty to be paid = 285214 PKR/- No. of Trucks = 29	Coal to be sent = 1426.07 tons Freight cost = 29000 PKR/- Amount of duty to be paid = 285214 PKR/- No. of Trucks = 29	Coal to be sent = 1426.07 tons Freight cost = 29000 PKR/- Amount of duty to be paid = 285214 PKR/- No. of Trucks = 29	Coal to be sent = 1426.07 tons Freight cost = 29000 PKR/- Amount of duty to be paid = 285214 PKR/- No. of Trucks = 29
6th Jul 2020, Monday	7th Jul 2020, Tuesday	8th Jul 2020, Wednesday	9th Jul 2020, Thursday	10th Jul 2020, Friday	11th Jul 2020, Saturday	12th Jul 2020, Sunday
Coal to be sent = 1426.07 tons Freight cost = 29000 PKR/- Amount of duty to be paid = 285214 PKR/- No. of Trucks = 29	Coal to be sent = 1426.07 tons Freight cost = 29000 PKR/- Amount of duty to be paid = 285214 PKR/- No. of Trucks = 29	Coal to be sent = 1426.07 tons Freight cost = 29000 PKR/- Amount of duty to be paid = 285214 PKR/- No. of Trucks = 29	Coal to be sent = 1426.07 tons Freight cost = 29000 PKR/- Amount of duty to be paid = 285214 PKR/- No. of Trucks = 29	Coal to be sent = 1426.07 tons Freight cost = 29000 PKR/- Amount of duty to be paid = 285214 PKR/- No. of Trucks = 29	Coal to be sent = 1426.07 tons Freight cost = 29000 PKR/- Amount of duty to be paid = 285214 PKR/- No. of Trucks = 29	Coal to be sent = 1426.07 tons Freight cost = 29000 PKR/- Amount of duty to be paid = 285214 PKR/- No. of Trucks = 29
13th Jul 2020, Monday	14th Jul 2020, Tuesday	15th Jul 2020, Wednesday	16th Jul 2020, Thursday	17th Jul 2020, Friday	18th Jul 2020, Saturday	19th Jul 2020, Sunday
Coal to be sent = 1426.07 tons Freight cost = 29000 PKR/- Amount of duty to be paid = 285214 PKR/- No. of Trucks = 29	Coal to be sent = 1426.07 tons Freight cost = 29000 PKR/- Amount of duty to be paid = 285214 PKR/- No. of Trucks = 29	Coal to be sent = 1426.07 tons Freight cost = 29000 PKR/- Amount of duty to be paid = 285214 PKR/- No. of Trucks = 29	Coal to be sent = 1426.07 tons Freight cost = 29000 PKR/- Amount of duty to be paid = 285214 PKR/- No. of Trucks = 29	Coal to be sent = 1426.07 tons Freight cost = 29000 PKR/- Amount of duty to be paid = 285214 PKR/- No. of Trucks = 29	Coal to be sent = 1426.07 tons Freight cost = 29000 PKR/- Amount of duty to be paid = 285214 PKR/- No. of Trucks = 29	Coal to be sent = 1426.07 tons Freight cost = 29000 PKR/- Amount of duty to be paid = 285214 PKR/- No. of Trucks = 29

Figure 76: Schedule Generation - Step 2

### 7.3.4. Graphs

Graph section allows the user to generate various graphs to analyze the summary of coal transportation. This will aid the company in making strategic decisions in future.

The following graph is an example;



Figure 77: Graphs – Example

These are the graphs showing the amount of coal transported each month for a year. And second graphs show freight cost company paid each month for a year.

## 7.4. Controls

The fourth tab in our web application is Control. It allows the user to create more account and restrict the action a specific user can perform in this software. This tab is depicted in the Figure below:

The screenshot shows a web browser window for 'MAPLE LEAF' with the URL 'localhost/makeuser.php'. The page has a header with links for Dashboard, Consignments, Reports, Controls, and Logout. The main area contains fields for User Name, Password, and Repeat Password, with a 'Submit' button. Below this is a section titled 'Existing Users' with a table listing two users: 'areeb' and 'admin'. The table columns are Username, Password, Time Created, and Action (Delete). Both users have a 'delete' link next to them.

Username:	Password:	Time Created:	Action
areeb	\$2y\$10\$NLqTzgRO.yYD1VsAqVmAXOVMQOkHW8GAdmldfEUYhrl9yC1Nnwe	2020-06-28 07:59:58	<a href="#">delete</a>
admin	\$2y\$10\$sv78z3p5MxsKwcPk3OkeHOWcSD8Q4/z/X6AddxL.TmMshhQ8RoE	2020-06-28 07:48:20	<a href="#">delete</a>

**Figure 78: Control Tab of Web Application**

The software is programmed as if any user other than “admin” tried to delete the existing users the error will generate and command will not go through.

## 7.5. Logout

Logout option, allows the user to logout from the web application and will take the user to landing page.

## 8. CONCLUSION

### 8.1. Concluding the ERP Software

The aim of this project was to develop an Enterprise Resource Planning software to cater the needs of Logistics process of Maple Leaf Cement.

We have successfully developed all modules of ERP system with required security and efficiency. To develop this software, we have written 15000+ lines of code and created 5 unique databases. These databases will be uploading on a server provided by the hosting account and a domain will be connected to that server. Domain of any type can be used.

This way, different modules of single ERP can be used at a time without hindering to its performance or efficiency. Also, it can access with Laptops, Mobile Phones, Personal Computers or any other device containing a browser and an internet connection.

### 8.2. Deliverables

At the start of this project, a Statement of Requirement [14] was created, containing the deliverables of the project. Table 27, indicates the current status of all our deliverables.

*Table 27: Project Deliverables and their Status*

D / W(H) / W(L)	Deliverables	Status
D	Software containing three pathways tracking of raw material.	✓
D	Transport scheduling of raw material via software.	✓
D	Financial management of raw material via software.	✓
D	Monthly report generation.	✓
D	Debugging of software.	✓
D	Final year project report	✓
D	Feedback oriented software.	✓
W(H)	Weekly report generation option in the software.	✓
W(L)	Daily report generation option in the software.	✓
W(L)	Inventory management of raw material via software.	✓

### 8.3. Future Prospect

The software we developed do not have limited extension and improvement. With future prospect in mind, this ERP system software can be made more efficient and productive by addition of the following aspects

- I. Addition of Schedule module for transportation of coal via train with availability of schedule provided by Pakistan Railway.
- II. Addition of features which can generate relevant report with various conditions.

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- III. Addition of graphical representation of various data to formulate a strategic decision in future.
- IV. Addition of modules to manage the distribution of cement.
- V. Addition of modules to manage the inventory level at the plant.

This ERP software is flexible enough to bear the addition of all these modules and at the end of the day, whole Enterprise can be improved and automated by using this single software.

## 9. APPENDIX A

### 9.1. Programming Code and Databases

In development of this web application we have written more than 15000 lines of codes and have created 5 unique databases.

#### 9.1.1. Databases

The first building block of client – server model [3.6.1] was database management system. Various databases were required to create this web application. We have used MySQL, as selected previously [4.2.1] to create all 5 unique databases.

##### 9.1.1.1. Database for Login Details

The database for login details contains the username and respective passwords. No username can be used other than present in the database to login in the web application. The username ADMIN is created by default. Only admin user can create new username and passwords.

Figure below contains the database for login details

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
1	primid	int(11)			No	None		AUTO_INCREMENT	Change  Drop  More
2	USERID	tinytext	utf8mb4_general_ci		No				Change  Drop  More
3	USERPASSWORD	longtext	utf8mb4_general_ci		No				Change  Drop  More
4	time	timestamp			No	current_timestamp()			Change  Drop  More

Figure 79: Database for Login Details

##### 9.1.1.2. Database for Vessel Details

This database contains all data regarding the coal that has been shipped in and present at the Port Qasim.

Figure below shows the database for vessel details

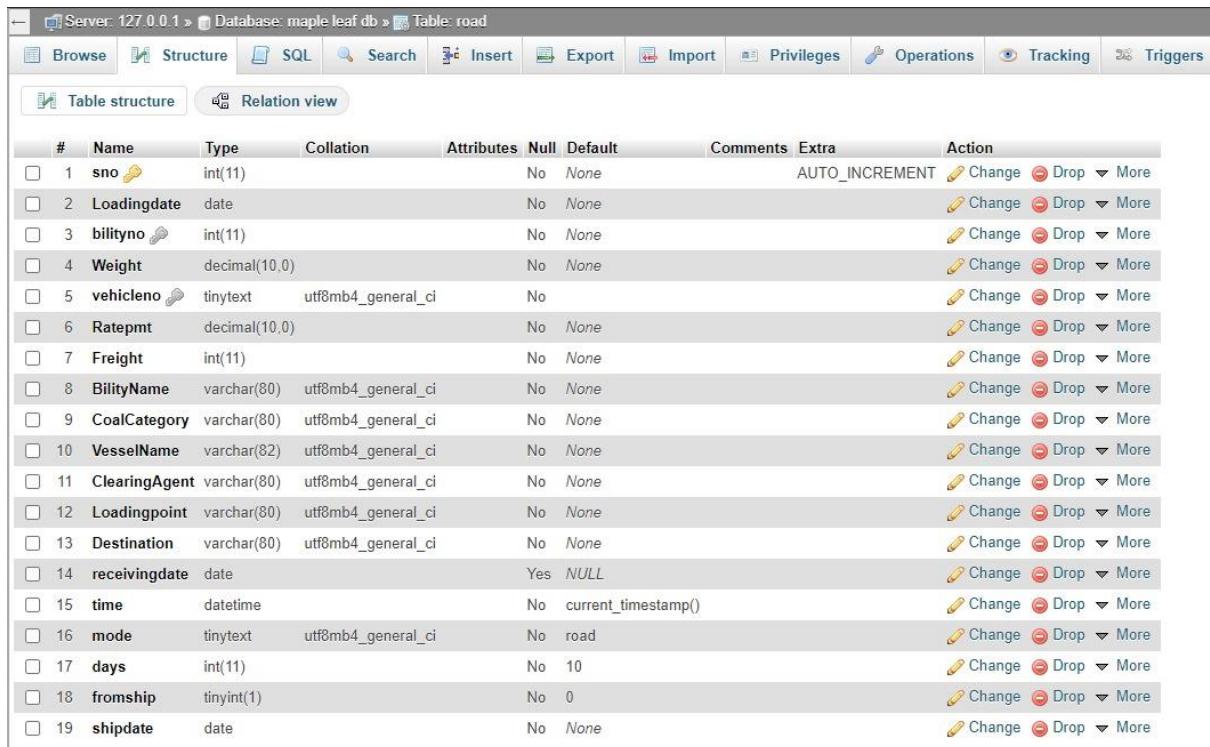
#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
1	id	int(11)			No	None		AUTO_INCREMENT	Change  Drop  More
2	shipname	varchar(82)	utf8mb4_general_ci		No	None			Change  Drop  More
3	amountofcoal	decimal(10,0)			No	None			Change  Drop  More
4	receivingdate	date			No	None			Change  Drop  More
5	CoalCategory	char(82)	utf8mb4_general_ci		Yes	NULL			Change  Drop  More
6	time	timestamp			No	current_timestamp()			Change  Drop  More

Figure 80: Database for Vessel Details

##### 9.1.1.3. Database for Transportation Via Truck

This database contains all record of coal transportation via truck. The following Figure depicts the database created for transportation of coal via truck.

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement



The screenshot shows the MySQL Workbench interface with the database 'maple leaf db' selected. The 'Table: road' is currently viewed. The table structure is displayed in a grid with columns: #, Name, Type, Collation, Attributes, Null, Default, Comments, Extra, and Action. The table contains 19 rows of data.

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
1	sno	int(11)			No	None		AUTO_INCREMENT	Change  Drop  More
2	Loadingdate	date			No	None			Change  Drop  More
3	bilityno	int(11)			No	None			Change  Drop  More
4	Weight	decimal(10,0)			No	None			Change  Drop  More
5	vehicleno	tinytext	utf8mb4_general_ci		No				Change  Drop  More
6	Ratepmt	decimal(10,0)			No	None			Change  Drop  More
7	Freight	int(11)			No	None			Change  Drop  More
8	BilityName	varchar(80)	utf8mb4_general_ci		No	None			Change  Drop  More
9	CoalCategory	varchar(80)	utf8mb4_general_ci		No	None			Change  Drop  More
10	VesselName	varchar(82)	utf8mb4_general_ci		No	None			Change  Drop  More
11	ClearingAgent	varchar(80)	utf8mb4_general_ci		No	None			Change  Drop  More
12	Loadingpoint	varchar(80)	utf8mb4_general_ci		No	None			Change  Drop  More
13	Destination	varchar(80)	utf8mb4_general_ci		No	None			Change  Drop  More
14	receivingdate	date			Yes	NULL			Change  Drop  More
15	time	datetime			No	current_timestamp()			Change  Drop  More
16	mode	tinytext	utf8mb4_general_ci		No	road			Change  Drop  More
17	days	int(11)			No	10			Change  Drop  More
18	fromship	tinyint(1)			No	0			Change  Drop  More
19	shipdate	date			No	None			Change  Drop  More

Figure 81: Database for Transportation Via Train

### 9.1.1.4. Database for Transportation Via Train

This database contains all data regarding the transportation of coal via train. The figure below shows the database for train record.

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

The screenshot shows the MySQL Workbench interface with the following details:

- Server:** 127.0.0.1
- Database:** maple leaf db
- Table:** train
- Table Structure:**

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
1	sno	int(11)			No	None		AUTO_INCREMENT	Change  Drop  More
2	shipname	varchar(82)	utf8mb4_general_ci		No	None			Change  Drop  More
3	shipdate	date			No	None			Change  Drop  More
4	rrno	int(11)			No	None			Change  Drop  More
5	invno	int(11)			No	None			Change  Drop  More
6	lodate	date			No	None			Change  Drop  More
7	rrdate	date			No	None			Change  Drop  More
8	wagonno	tinytext	utf8mb4_general_ci		No				Change  Drop  More
9	weight	decimal(10,0)			No	None			Change  Drop  More
10	charged	decimal(10,0)			No	None			Change  Drop  More
11	freight	decimal(10,0)			No	None			Change  Drop  More
12	lhc	decimal(10,0)			No	None			Change  Drop  More
13	lmc	decimal(10,0)			No	None			Change  Drop  More
14	dutycharged	decimal(10,0)			No	None			Change  Drop  More
15	siding	tinytext	utf8mb4_general_ci		No				Change  Drop  More
16	25percent	decimal(10,0)			No	None			Change  Drop  More
17	overload	decimal(10,0)			No	None			Change  Drop  More
18	total	decimal(10,0)			No	None			Change  Drop  More
19	totalpayment	decimal(10,0)			No	None			Change  Drop  More
20	weighmentcharges	decimal(10,0)			No	None			Change  Drop  More
21	paymentdate	date			Yes	NULL			Change  Drop  More
22	rakeno	varchar(255)	utf8mb4_general_ci		Yes	NULL			Change  Drop  More
23	time	datetime			No	current_timestamp()			Change  Drop  More
24	mode	tinytext	utf8mb4_general_ci		No	train			Change  Drop  More
25	destination	varchar(255)	utf8mb4_general_ci		No	KMLG Plant Daud Khel			Change  Drop  More
26	receivingdate	date			Yes	NULL			Change  Drop  More
27	days	int(11)			No	50			Change  Drop  More

**Figure 82: Database for Transportation Via Train**

### 9.1.1.5. Database for Rake

This database records all rake data. The figure below depicts this database.

The screenshot shows the MySQL Workbench interface with the following details:

- Server:** 127.0.0.1
- Database:** maple leaf db
- Table:** railwayrake
- Table Structure:**

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
1	id	int(11)			No	None		AUTO_INCREMENT	Change  Drop  More
2	rakeno	varchar(255)	utf8mb4_general_ci		No	None			Change  Drop  More
3	departuredate	date			No	None			Change  Drop  More
4	receivingdate	date			Yes	NULL			Change  Drop  More
5	time	datetime			No	current_timestamp()			Change  Drop  More
6	mode	tinytext	utf8mb4_general_ci		No	train			Change  Drop  More
7	Loadingpoint	varchar(80)	utf8mb4_general_ci		No	None			Change  Drop  More
8	destination	varchar(80)	utf8mb4_general_ci		No	KMLG Plant Daud Khel			Change  Drop  More
9	noofwagons	decimal(10,0)			No	None			Change  Drop  More
10	shipname	varchar(82)	utf8mb4_general_ci		No	None			Change  Drop  More
11	shipdate	date			No	None			Change  Drop  More

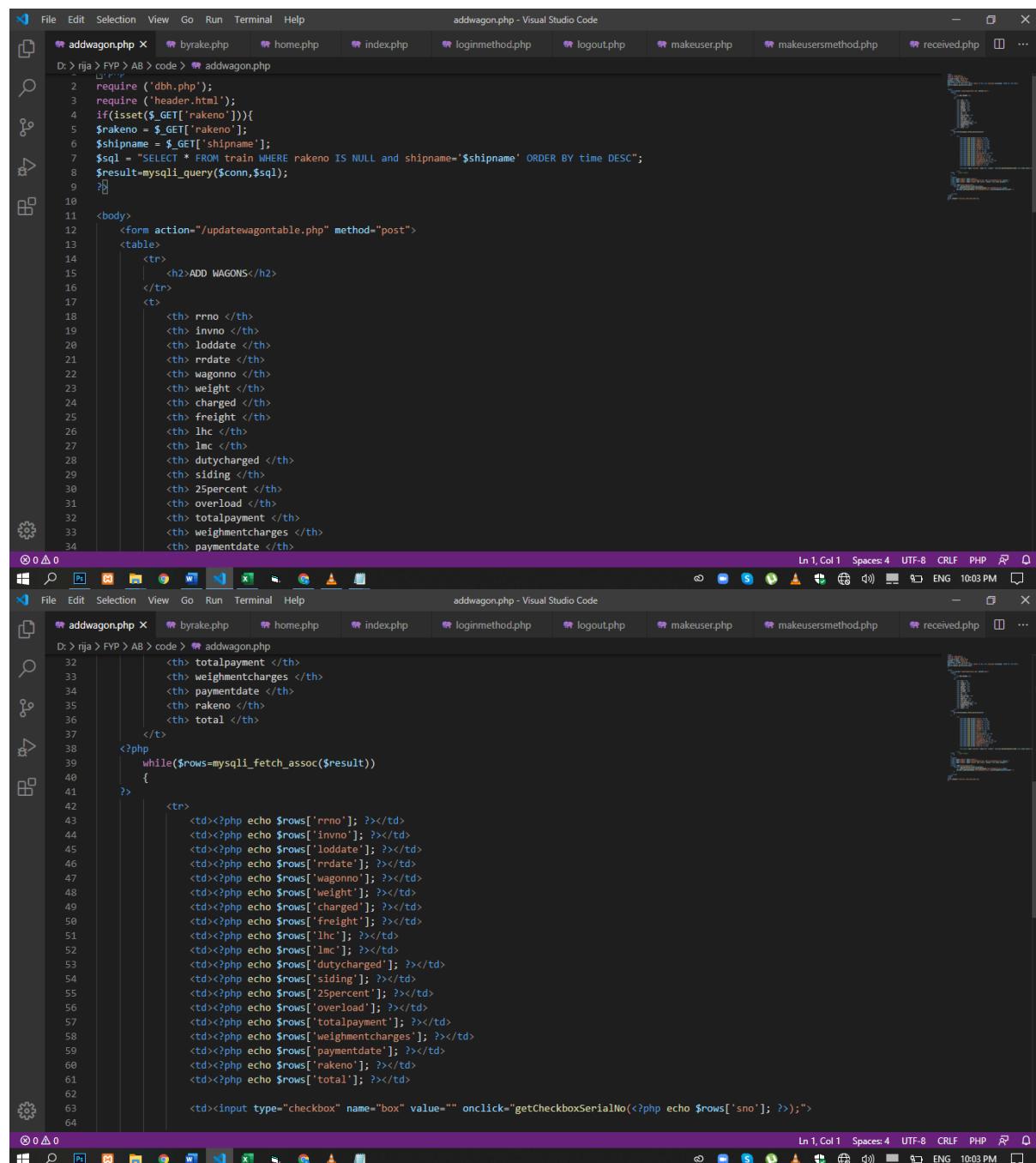
**Figure 83: Database for Rake Creation**

### 9.1.2. Programming Code

To create this web application, various languages has been used. The following section contain the code for used to create remaining building blocks of Client – Server Model.

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

In order to simplify, we have distributed the building blocks in further sub-categories (each action that can be perform in the web application) according to the requirement of this project. Following is the programming code.



The image shows two side-by-side instances of the Visual Studio Code editor, both displaying the same PHP file named 'addwagon.php'. The code is a form for adding wagon details, including fields for rrno, invno, lddate, rrdate, wagonno, weight, charged, freight, lhc, lmc, siding, 25percent, overload, totalpayment, weighmentcharges, and paymentdate. It also includes logic to handle a checkbox named 'box' with an onclick event that calls a function to get a serial number based on the sno value.

```
D:\rja>FYP>AB>code> addwagon.php
1 <?php
2     require ('dbh.php');
3     require ('header.html');
4     if(isset($_GET['rakeno'])){
5         $rakeno = $_GET['rakeno'];
6         $shipname = $_GET['shipname'];
7         $sql = "SELECT * FROM train WHERE rakeno IS NULL and shipname='$shipname' ORDER BY time DESC";
8         $result=mysqli_query($conn,$sql);
9     }
10
11    <body>
12        <form action="/updatewagontable.php" method="post">
13            <table>
14                <tr>
15                    <th> rrno </th>
16                    <th> invno </th>
17                    <th> lddate </th>
18                    <th> rrdate </th>
19                    <th> wagonno </th>
20                    <th> weight </th>
21                    <th> charged </th>
22                    <th> freight </th>
23                    <th> lhc </th>
24                    <th> lmc </th>
25                    <th> siding </th>
26                    <th> 25percent </th>
27                    <th> overload </th>
28                    <th> totalpayment </th>
29                    <th> weighmentcharges </th>
30                    <th> paymentdate </th>
31                </tr>
32            </table>
33        </form>
34    </body>
35    <?php
36        while($rows=mysqli_fetch_assoc($result))
37        {
38            <tr>
39                <td><?php echo $rows['rrno']; ?></td>
40                <td><?php echo $rows['invno']; ?></td>
41                <td><?php echo $rows['lddate']; ?></td>
42                <td><?php echo $rows['rrdate']; ?></td>
43                <td><?php echo $rows['wagonno']; ?></td>
44                <td><?php echo $rows['weight']; ?></td>
45                <td><?php echo $rows['charged']; ?></td>
46                <td><?php echo $rows['freight']; ?></td>
47                <td><?php echo $rows['lhc']; ?></td>
48                <td><?php echo $rows['lmc']; ?></td>
49                <td><?php echo $rows['siding']; ?></td>
50                <td><?php echo $rows['25percent']; ?></td>
51                <td><?php echo $rows['overload']; ?></td>
52                <td><?php echo $rows['totalpayment']; ?></td>
53                <td><?php echo $rows['weighmentcharges']; ?></td>
54                <td><?php echo $rows['paymentdate']; ?></td>
55                <td><?php echo $rows['rakeno']; ?></td>
56                <td><?php echo $rows['total']; ?></td>
57            </tr>
58        }
59    <?php
60        <td><input type="checkbox" name="box" value="" onclick="getCheckboxSerialNo(<?php echo $rows['sno']; ?>);">
61    </td>
62
63
64
```

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

The screenshot shows two instances of Visual Studio Code side-by-side, both displaying PHP code.

**Top Window (Visual Studio Code):**

```
D: > rija > FYP > AB > code > addwagon.php
53     <td><?php echo $rows['dutychanged']; ?></td>
54     <td><?php echo $rows['siding']; ?></td>
55     <td><?php echo $rows['25percent']; ?></td>
56     <td><?php echo $rows['overload']; ?></td>
57     <td><?php echo $rows['totalpayment']; ?></td>
58     <td><?php echo $rows['weightmentcharges']; ?></td>
59     <td><?php echo $rows['paymentdate']; ?></td>
60     <td><?php echo $rows['rakeno']; ?></td>
61     <td><?php echo $rows['total']; ?></td>
62
63     <td><input type="checkbox" name="box" value="" onclick="getCheckboxSerialNo(<?php echo $rows['sno']; ?>);">
64
65   </tr>
66   <?php //don't remove
67   |   ?
68   ?>
69 </table>
70 <input type="submit" name="submit">
71 <input type="hidden" name="serialNumberArray" id="serialNumberArray" value="">
72 <input type="hidden" name="rakeno" id="rakeno" value="<?php echo $rakeno;?>">
73 </form>
74 <script type="text/javascript">
75   function getCheckboxSerialNo(serialId){
76     var hiddenValue=document.getElementById("serialNumberArray").value;
77     document.getElementById("serialNumberArray").value=hiddenValue+serialId+",";
78   }
79 </script>
80 </body>
81 </php>
82 }else {header("location:/editrake.php");}
83 ?>
```

**Bottom Window (Visual Studio Code):**

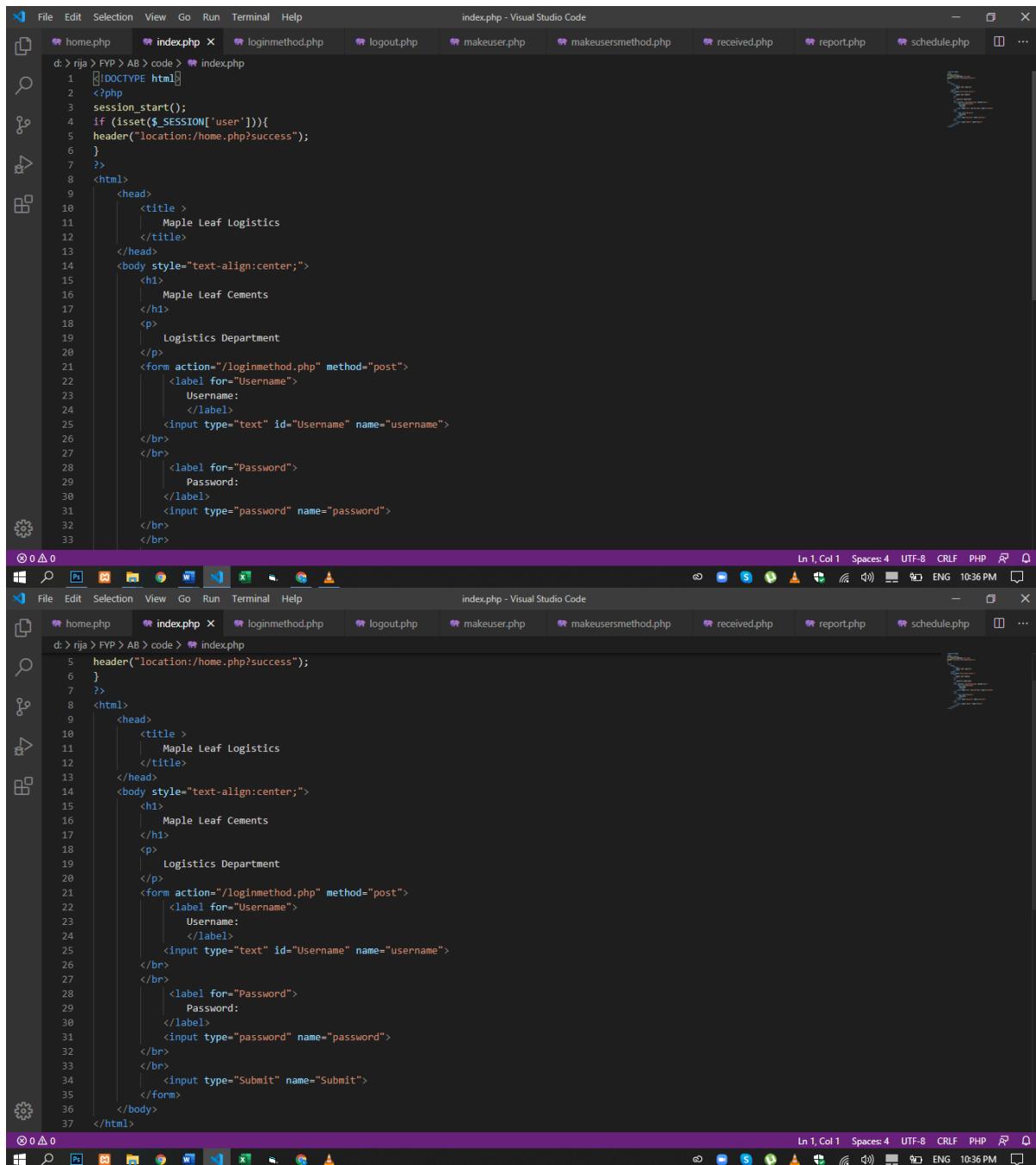
```
d: > rija > FYP > AB > code > byrake.php
1 <?php
2 require ('dbh.php');
3 include ('header.html')
4 ?>
5
6 <html>
7 <head>
8 <meta name="viewport" content="width=device-width, initial-scale=1">
9 <body style="text-align:center;">
10   <form action="/createrrake.php" method="post">
11     <table>
12       <tr>
13         <td>Railway Rake:</td>
14         <td><input type="text" id="rake" name="rake"></td>
15       </tr>
16       <tr>
17         <td>Departure Date:</td>
18         <td><input type="date" id="date" name="date" value="<?php echo date('Y-m-d'); ?>"></td>
19       </tr>
20       <tr>
21         <td>Loading Point:</td>
22         <td><input type="text" id="from" name="from"></td>
23       </tr>
24       <tr>
25         <td>Vessel Name:</td>
26         <td>
27           <select name="vesselname" id="vesselname">
28             <?php
29             require 'dbh.php';
30             $sql = "SELECT * FROM ship where amountofcoal > 0";
31             $result = mysqli_query($conn,$sql);
32             while($rows=mysqli_fetch_assoc($result))
33             { ?>
```

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

The screenshot shows three instances of Visual Studio Code side-by-side, each displaying a PHP file:

- byrake.php - Visual Studio Code (Top):** This file contains code for displaying recorded railway rake data. It includes an SQL query to select records where AMOUNTOTCOKA > 0, a loop to fetch rows, and an HTML form with a submit button.
- byrake.php - Visual Studio Code (Middle):** This file contains code for displaying recorded railway rake data. It includes an SQL query to select all records from railwayrake ORDER BY time DESC LIMIT 10, a loop to fetch rows, and an HTML table with columns for Rake ID, Departure Date, Loading Point, Destination, and Number of Wagons. It also includes a delete link for each row.
- home.php - Visual Studio Code (Bottom):** This file contains session handling code. It starts a session, checks if a user is logged in (via \$\_SESSION['user']), and if not, redirects to index.php. It also includes code to log the user out.

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement



```
d: > rja > FYP > AB > code > index.php
1 |<!DOCTYPE html>
2 |<?php
3 | session_start();
4 | if (isset($_SESSION['user'])) {
5 | header("location:/home.php?success");
6 |
7 |>
8 |<html>
9 |<head>
10 |<title>
11 | | Maple Leaf Logistics
12 |</title>
13 |</head>
14 |<body style="text-align:center;">
15 | | Maple Leaf Cements
16 |</h1>
17 |<p>
18 | | Logistics Department
19 |</p>
20 |<form action="/loginmethod.php" method="post">
21 | |<label for="Username">
22 | | | Username:
23 | |</label>
24 | |<input type="text" id="Username" name="username">
25 |<br>
26 |<br>
27 | |<label for="Password">
28 | | | Password:
29 | |</label>
30 | |<input type="password" name="password">
31 |<br>
32 |<br>
33 |</form>
34 |</body>
35 |</html>
```

```
d: > rja > FYP > AB > code > index.php
5 | header("location:/home.php?success");
6 |
7 |>
8 |<html>
9 |<head>
10 |<title>
11 | | Maple Leaf Logistics
12 |</title>
13 |</head>
14 |<body style="text-align:center;">
15 | | Maple Leaf Cements
16 |</h1>
17 |<p>
18 | | Logistics Department
19 |</p>
20 |<form action="/loginmethod.php" method="post">
21 | |<label for="Username">
22 | | | Username:
23 | |</label>
24 | |<input type="text" id="Username" name="username">
25 |<br>
26 |<br>
27 | |<label for="Password">
28 | | | Password:
29 | |</label>
30 | |<input type="password" name="password">
31 |<br>
32 |<br>
33 | |<input type="Submit" name="Submit">
34 |</form>
35 |</body>
36 |</html>
```

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

The screenshot shows three tabs open in Visual Studio Code:

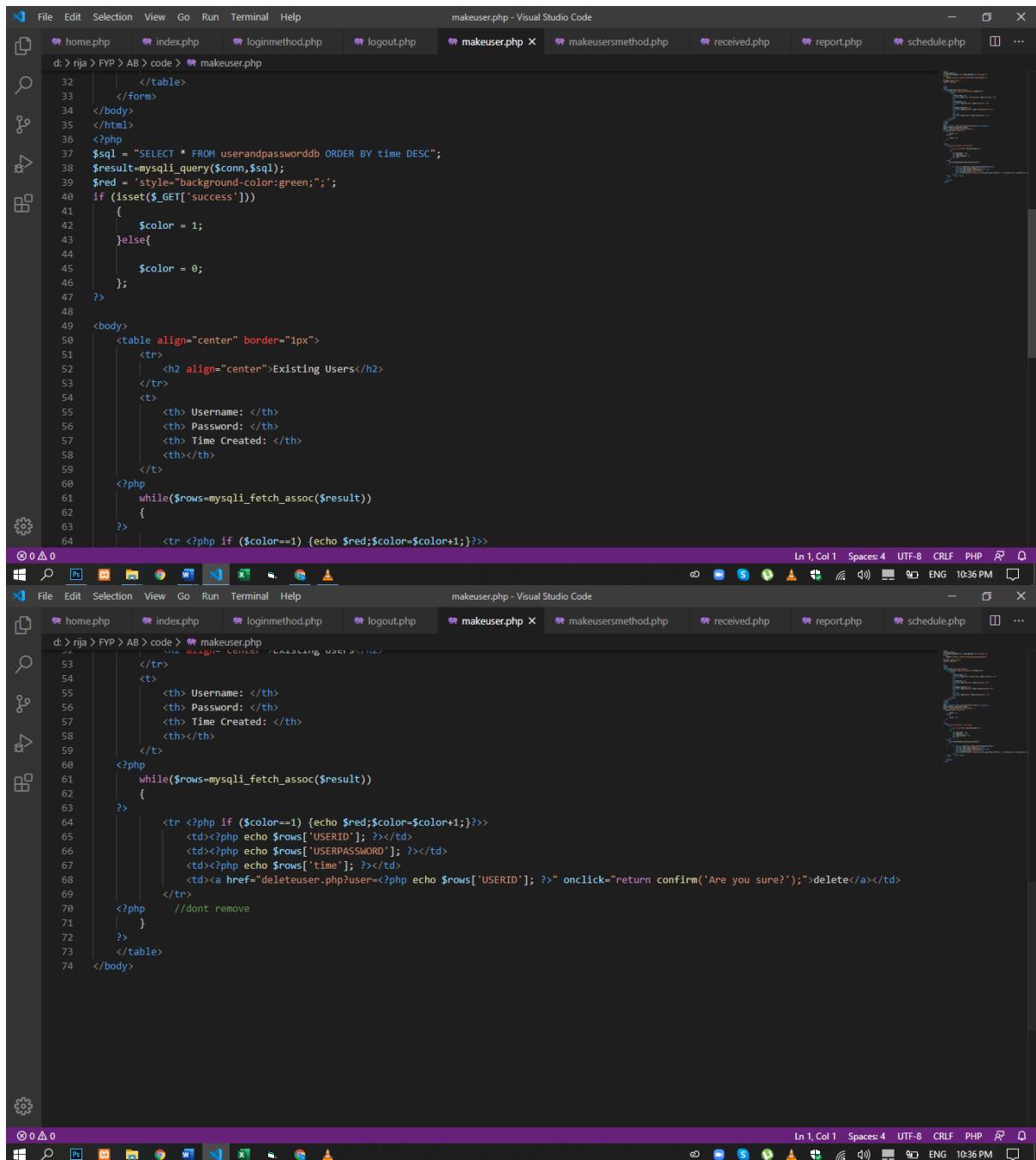
- loginmethod.php - Visual Studio Code**:

```
d: > rija > FYP > AB > code > loginmethod.php
1 <?php
2 if(isset($_POST['Submit'])){
3 require 'dbh.php';
4 $username = $_POST['username'];
5 $password = $_POST['password'];
6 $sql = "SELECT * FROM userandpassworddb WHERE USERID=?";
7 $stmt = mysqli_stmt_init($conn);
8 mysqli_stmt_prepare($stmt,$sql);
9 mysqli_stmt_bind_param($stmt, 's',$username);
10 mysqli_stmt_execute($stmt);
11 $result = mysqli_stmt_get_result($stmt);
12 if($row = mysqli_fetch_assoc($result)){
13 $passwordcheck = password_verify($password, $row['USERPASSWORD']);
14 }
15 if($passwordcheck == false){
16 header("location:/index.php?error=usernameorpasswordisincorrect");
17 }
18 if($passwordcheck == true){
19 session_start();
20 $_SESSION['user']=$row[USERID];
21 $_SESSION['primaryid']=$row[primid];
22 header("location:/dashboard.php?success");
23 }
24 }else{
25 header("location:/index.php?pleaseLOGIN");
26 }
```
- logout.php - Visual Studio Code**:

```
d: > rija > FYP > AB > code > logout.php
1 <?php
2 session_start();
3 session_unset();
4 session_destroy();
5 header("location:/index.php?loggedout");
```
- makeuser.php - Visual Studio Code**:

```
d: > rija > FYP > AB > code > makeuser.php
1 <?php
2 session_start();
3 if (isset($_SESSION['user'])&&$_SESSION['user']=='admin'){
4 }else{
5 header("location:/controls.php?pleaseLoginWithAdmin");
6 }
7 include('header.html');
8 require 'dbh.php';
9
10 ?>
11 <html>
12 <head>
13 <body style="text-align:center;">
14 <form action="/makeusersmethod.php" method="post">
15     <table>
16         <tr>
17             <td>User Name:</td>
18             <td><input type="text" id="Username" name="username"></td>
19         </tr>
20         <tr>
21             <td>Password:</td>
22             <td><input type="password" name="password"></td>
23         </tr>
24         <tr>
25             <td>Repeat Password:</td>
26             <td><input type="password" name="repeatpassword"></td>
27         </tr>
28         <tr>
29             <td><input type="Submit" name="makeneWuser"></td>
30         </tr>
31     </table>
32 </form>
33 
```

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

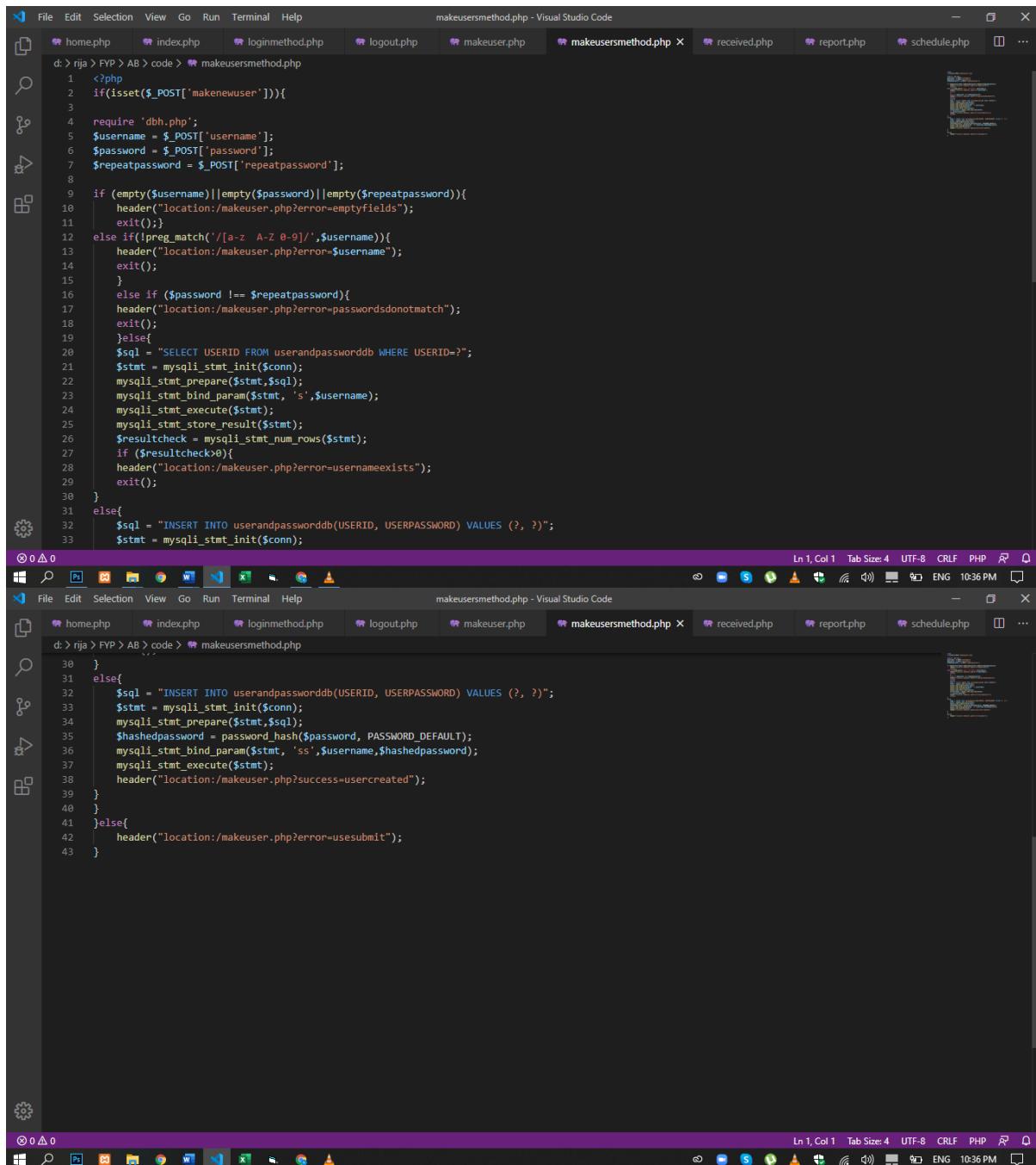


The image shows three vertically stacked windows of the Visual Studio Code (VS Code) editor, all displaying the same PHP file: `makeuser.php`. The code is used for managing user accounts, specifically for displaying existing users and handling user deletion.

```
File Edit Selection View Go Run Terminal Help makeuser.php - Visual Studio Code
d: rija > rija > AB > code > makeuser.php
32 |     </form>
33 |   </body>
34 | </html>
35 | </php>
36 | $sql = "SELECT * FROM userandpassworddb ORDER BY time DESC";
37 | $result=mysqli_query($conn,$sql);
38 | $red = 'style="background-color:green;"';
39 | if (isset($_GET['success']))
40 | {
41 |     $color = 1;
42 | }else{
43 |
44 |     $color = 0;
45 |
46 | };
47 |>>
48 |>
49 |<body>
50 |     <table align="center" border="1px">
51 |         <tr>
52 |             <th align="center">Existing Users</th>
53 |         </tr>
54 |         <t>
55 |             <th> Username: </th>
56 |             <th> Password: </th>
57 |             <th> Time Created: </th>
58 |             <th></th>
59 |         </t>
60 |         <?php
61 |             while($rows=mysqli_fetch_assoc($result))
62 |             {
63 |                 <tr ><?php if ($color==1) {echo $red;$color=$color+1;}?>>>
64 |                     <td><?php echo $rows['USERID']; ?></td>
65 |                     <td><?php echo $rows['USERPASSWORD']; ?></td>
66 |                     <td><?php echo $rows['time']; ?></td>
67 |                     <td><a href="deleteuser.php?user=<?php echo $rows['USERID']; ?>" onclick="return confirm('Are you sure?');">delete</a></td>
68 |                 </tr>
69 |             <?php
70 |                 //dont remove
71 |             }
72 |         </table>
73 |     </body>
74 |>
```

The code includes logic to sort users by creation time, change the background color of rows (green for success), and provide a delete function with a confirmation dialog.

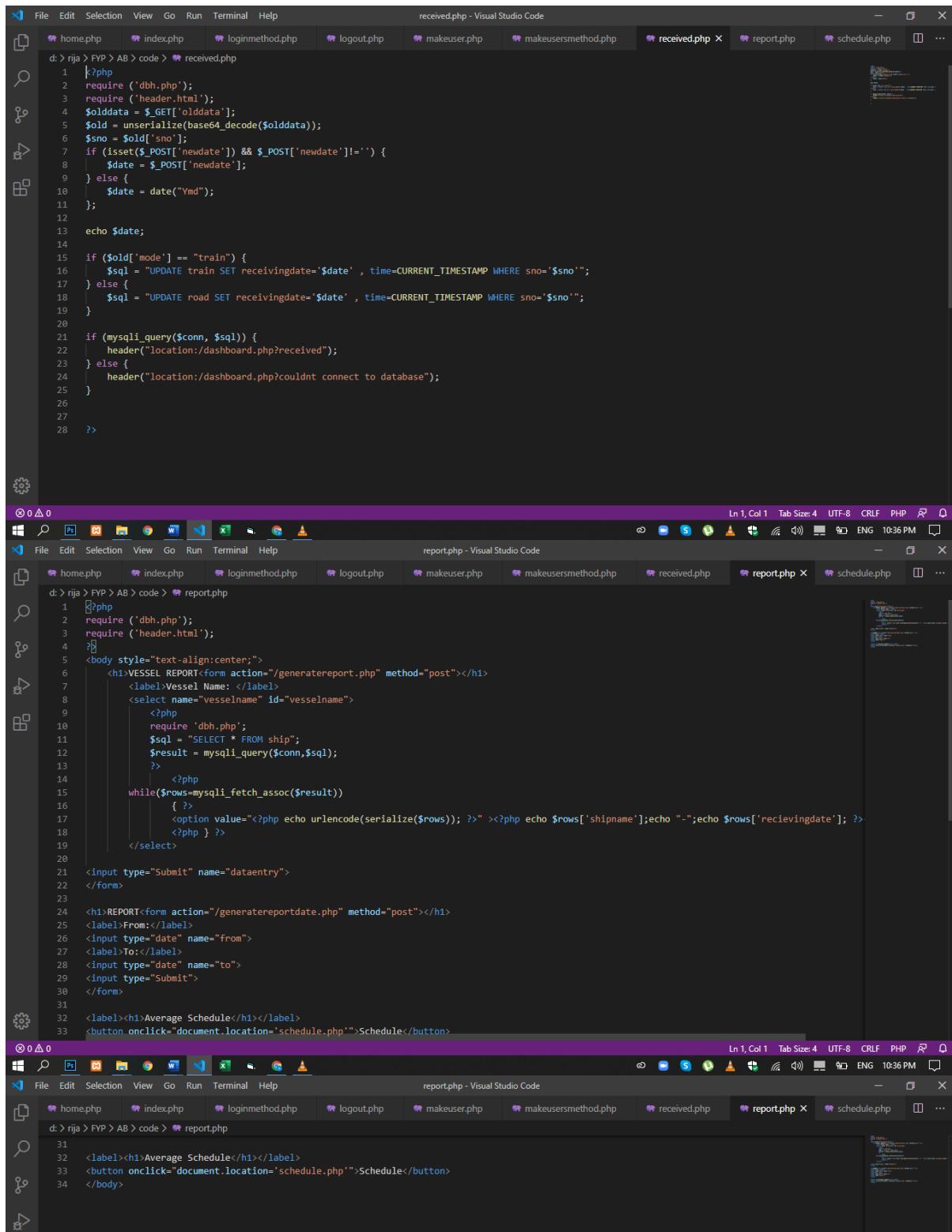
## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement



The image shows three vertically stacked windows of a Visual Studio Code interface, each displaying a different section of a PHP script for user creation. The script uses MySQLi prepared statements to handle user input and database operations.

```
d: > rija > FYP > AB > code > makeusersmethod.php
1  <>php
2  if(isset($_POST['makenewuser'])){
3
4  require 'dbh.php';
5  $username = $_POST['username'];
6  $password = $_POST['password'];
7  $repeatpassword = $_POST['repeatpassword'];
8
9  if (empty($username)||empty($password)||empty($repeatpassword)){
10    header("location:/makeuser.php?error=emptyfields");
11    exit();
12  else if(!preg_match( /[a-z A-Z 0-9]/,$username)){
13    header("location:/makeuser.php?error=$username");
14    exit();
15  }
16  else if ($password != $repeatpassword){
17    header("location:/makeuser.php?error=passwordsdonotmatch");
18    exit();
19  }else{
20    $sql = "SELECT USERID FROM userandpassworddb WHERE USERID=?";
21    $stmt = mysqli_stmt_init($conn);
22    mysqli_stmt_prepare($stmt,$sql);
23    mysqli_stmt_bind_param($stmt, 's',$username);
24    mysqli_stmt_execute($stmt);
25    mysqli_stmt_store_result($stmt);
26    $resultcheck = mysqli_stmt_num_rows($stmt);
27    if ($resultcheck>0){
28      header("location:/makeuser.php?error=usernameexists");
29      exit();
30    }else{
31      $sql = "INSERT INTO userandpassworddb(USERID, USERPASSWORD) VALUES (?, ?)";
32      $stmt = mysqli_stmt_init($conn);
33      mysqli_stmt_prepare($stmt,$sql);
34      $hashedpassword = password_hash($password, PASSWORD_DEFAULT);
35      mysqli_stmt_bind_param($stmt, 'ss',$username,$hashedpassword);
36      mysqli_stmt_execute($stmt);
37      header("location:/makeuser.php?success=usercreated");
38    }
39  }
40  }
41 }else{
42   header("location:/makeuser.php?error=usesubmit");
43 }
```

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement



The image displays three separate instances of the Visual Studio Code editor, each showing a different PHP file:

- Received.php:** This file handles the update of receiving dates in the database. It includes logic to check if a new date is provided via POST, and if so, updates the 'receivingdate' field in either the 'train' or 'read' table based on the 'mode' value. It also checks if the connection to the database is successful and provides appropriate headers.
- Report.php:** This file contains HTML and PHP code for generating a vessel report. It starts with a form for selecting a vessel name from a dropdown menu populated by a query to the 'ship' table. Below this is another form for generating a report date range. A button at the bottom allows navigating to the 'schedule.php' page.
- Schedule.php:** This file contains a single line of code that generates an average schedule, which is then passed to the report.php page via an onclick event.

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

The screenshot shows three tabs open in Visual Studio Code:

- schedule.php**: A PHP script for scheduling vessel names. It includes a form with fields for vessel name, cost, axle load, duty, and time, along with a submit button.
- test.php**: A PHP script that queries the database for the maximum loddate for a specific train and prints the result.
- updatewagonable.php**: A PHP script that handles the addition of new wagons to a railway rake. It processes POST data, queries the database for existing wagon counts, and updates the database with new values.

```
schedule.php (Top Tab):
```

```
d: > rija > FYP > AB > code > schedule.php
3 include('header.html')
4 <?php
5     <label>Vessel Name:</label>
6     <form action="generateschedule.php" method="post" autocomplete="on">
7         <select name="vesselname" id="vesselname">
8             <?php
9                 require 'dbh.php';
10                $sql = "SELECT * FROM ship where amountofcoal > 0";
11                $result = mysqli_query($conn,$sql);
12            >
13            <?php
14                while($rows=mysqli_fetch_assoc($result))
15                {
16                >
17                    <option value=<?php echo $rows['id']; ?>><?php echo $rows['shipname']; ?></option>
18                }
19            >
20        </select>
21        <label>COST:</label>
22        <input type="text" name="pt" placeholder="PKR/MEGATON">
23        <label>AXLELOAD:</label>
24        <input type="text" name="al" placeholder="MEGATON">
25        <label>DUTY:</label>
26        <input type="text" name="d" placeholder="PKR/TON">
27        <label>TIME:</label>
28        <input type="text" name="t" placeholder="DAYS TO PICK UP COAL">
29
30        <input type="Submit" name="schedule">
31
32
33
34
35    </form>
```

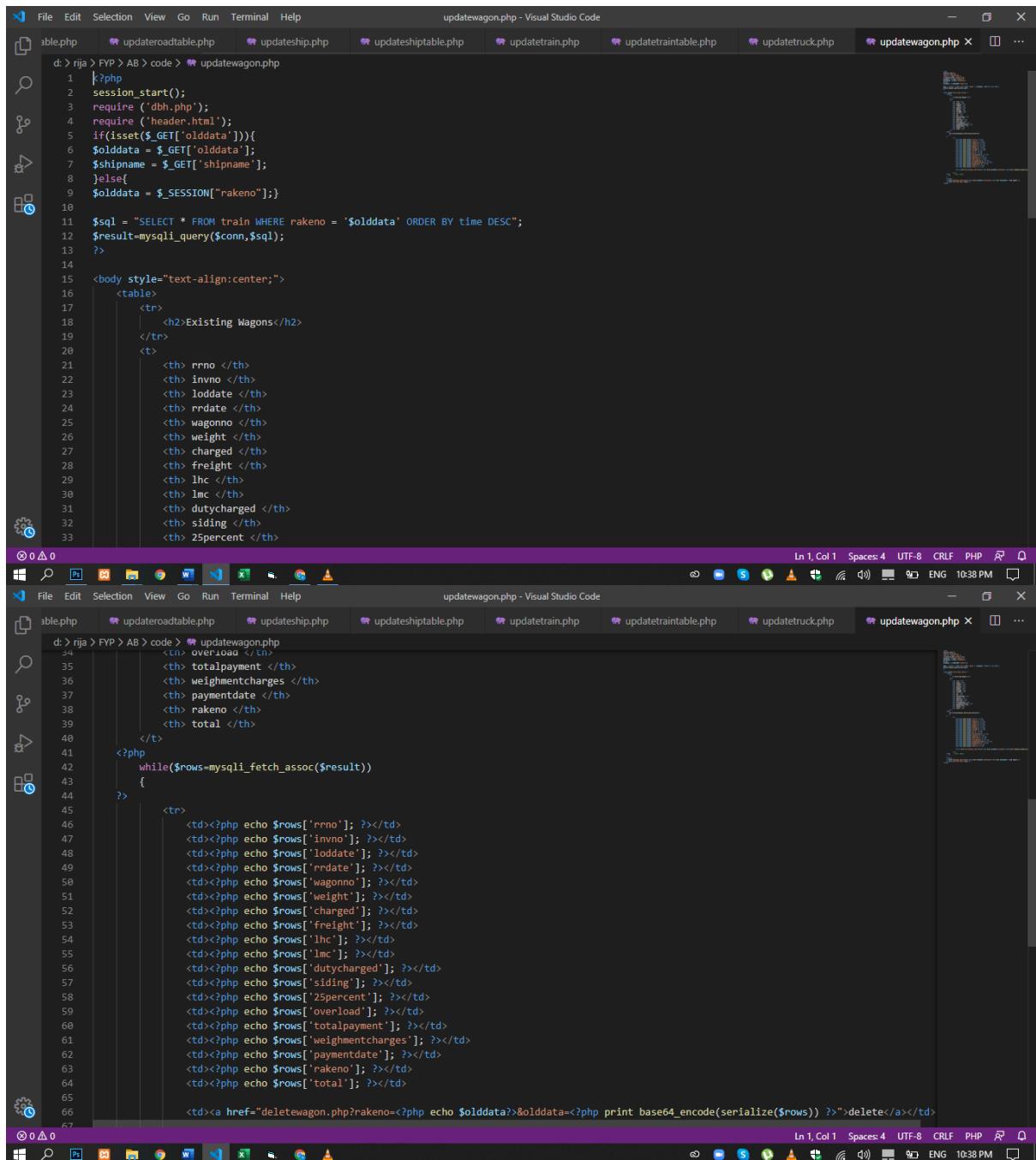
```
test.php (Middle Tab):
```

```
d: > rija > FYP > AB > code > test.php
1 <?php
2     require ('dbh.php');
3
4     $stabledate = "SELECT MAX(loddate) FROM train WHERE rakeno='dfasdfsdf1312' AND shipname='areeeeb'";
5     $columndate = mysqli_query($conn, $stabledate);
6     echo '<pre>'; print_r($columndate); echo '</pre>';
7     $DF = mysqli_fetch_assoc($columndate);
8     print_r($DF);
```

```
updatewagonable.php (Bottom Tab):
```

```
d: > rija > FYP > AB > code > updatewagonable.php
1 <?php
2     require ('dbh.php');
3     $index = $_POST['serialNumberArray'];
4     $myArray = explode(',', $index);
5     $noofwagons1 = sizeof($myArray);
6     $newwagons = $noofwagons1 - 1;
7
8     $rakeno = $_POST['rakeno'];
9     $noofwagon = mysqli_query($conn,"SELECT noofwagons FROM railwayrake WHERE rakeno='$rakeno'");
10    $rows=mysqli_fetch_assoc($noofwagon);
11    $oldwagons=$rows['noofwagons'];
12
13    $insertwagon= $newwagons+$oldwagons;
14    $wagon = "UPDATE railwayrake SET noofwagons ='$insertwagon' WHERE rakeno='$rakeno'";
15    mysqli_query($conn, $wagon);
16    | $SESSION["rakeno"] = $rakeno;
17    header("location:/updatewagon.php");
18
19    $b = 0;
20    while ($b<sizeof($myArray))
21    {
22        $sql = "UPDATE train SET rakeno='$rakeno' WHERE sno=$myArray[$b];";
23        mysqli_query($conn,$sql);
24        $b = $b + 1;
25    }
26    header("location:/editrake.php?wagonsadded");
```

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement



The image shows two instances of Visual Studio Code side-by-side, both displaying PHP code related to wagon management in a logistics system.

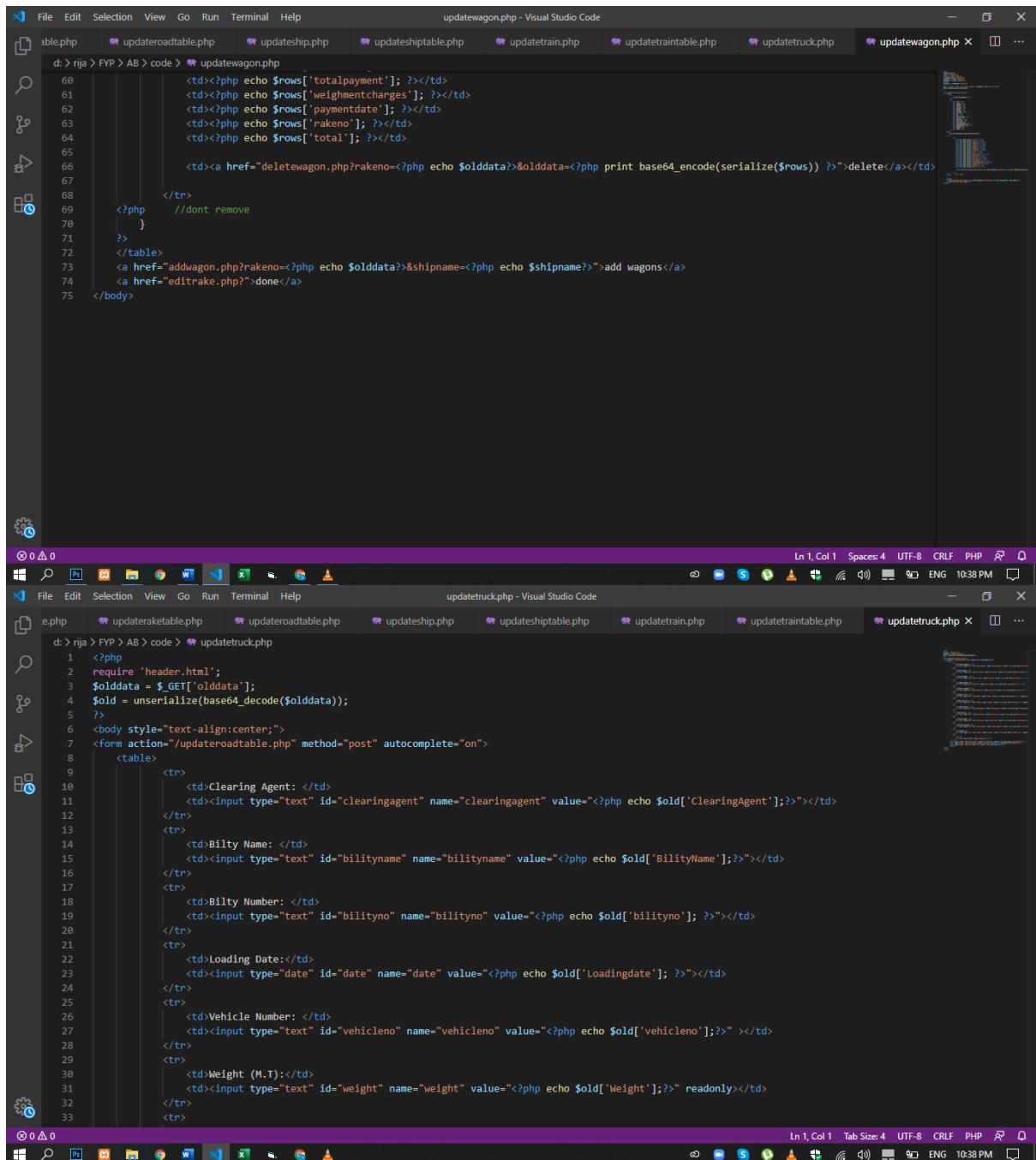
**Top Window (Line 33):**

```
d: > rja > FYP > AB > code > updatewagon.php
1 |<?php
2 | session_start();
3 | require ('dbh.php');
4 | require ('header.html');
5 | if(isset($_GET['olddata'])){
6 | $olddata = $_GET['olddata'];
7 | $shipname = $_GET['shipname'];
8 | }else{
9 | $olddata = $_SESSION["rakeno"];
10 |
11 $sql = "SELECT * FROM train WHERE rakeno = '$olddata' ORDER BY time DESC";
12 $result=mysqli_query($conn,$sql);
13 >
14
15 <body style="text-align:center;">
16   <table>
17     <tr>
18       |   <h2>Existing Wagons</h2>
19     </tr>
20     <t>
21       <th> rrno </th>
22       <th> invno </th>
23       <th> loddate </th>
24       <th> rrdate </th>
25       <th> wagonno </th>
26       <th> weight </th>
27       <th> charged </th>
28       <th> freight </th>
29       <th> lhc </th>
30       <th> lmc </th>
31       <th> dutycharged </th>
32       <th> siding </th>
33       <th> 25percent </th>
```

**Bottom Window (Line 67):**

```
d: > rja > FYP > AB > code > updatewagon.php
34 <tr>
35   <td> overload </td>
36   <td> totalpayment </td>
37   <td> weightmentcharges </td>
38   <td> paymentdate </td>
39   <td> rakeno </td>
40   <td> total </td>
41 </tr>
42 <?php
43 while($rows=mysqli_fetch_assoc($result))
44 {
45   <tr>
46     <td><?php echo $rows['rrno']; ?></td>
47     <td><?php echo $rows['invno']; ?></td>
48     <td><?php echo $rows['loddate']; ?></td>
49     <td><?php echo $rows['rrdate']; ?></td>
50     <td><?php echo $rows['wagonno']; ?></td>
51     <td><?php echo $rows['weight']; ?></td>
52     <td><?php echo $rows['charged']; ?></td>
53     <td><?php echo $rows['freight']; ?></td>
54     <td><?php echo $rows['lhc']; ?></td>
55     <td><?php echo $rows['lmc']; ?></td>
56     <td><?php echo $rows['dutycharged']; ?></td>
57     <td><?php echo $rows['siding']; ?></td>
58     <td><?php echo $rows['25percent']; ?></td>
59     <td><?php echo $rows['overload']; ?></td>
60     <td><?php echo $rows['totalpayment']; ?></td>
61     <td><?php echo $rows['weightmentcharges']; ?></td>
62     <td><?php echo $rows['paymentdate']; ?></td>
63     <td><?php echo $rows['rakeno']; ?></td>
64     <td><?php echo $rows['total']; ?></td>
65
66   <td><a href="deletewagon.php?rakeno=<?php echo $olddata?>&olddata=<?php print base64_encode(serial化($rows)) ?>">delete</a></td>
```

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement



The image shows two side-by-side instances of Visual Studio Code. Both instances have tabs for multiple files, with the active tab being 'updatewagon.php' in the top instance and 'updatetruck.php' in the bottom instance. The code in both files is PHP, related to updating tables in a database.

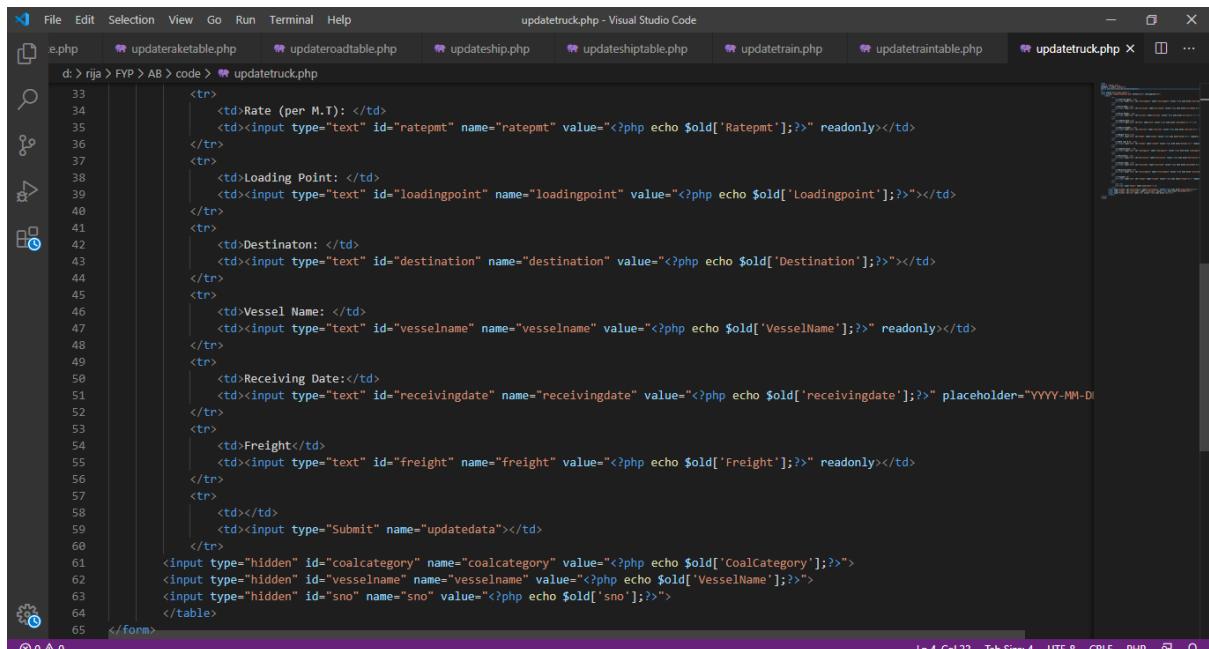
**updatewagon.php (Top Instance):**

```
d: > rja > FYP > AB > code > updatewagon.php
60     <td><?php echo $rows['totalpayment']; ?></td>
61     <td><?php echo $rows['weightmentcharges']; ?></td>
62     <td><?php echo $rows['paymentdate']; ?></td>
63     <td><?php echo $rows['rakeno']; ?></td>
64     <td><?php echo $rows['total']; ?></td>
65
66     <td><a href="deletewagon.php?rakeno=<?php echo $olddata?>&olddata=<?php print base64_encode(serialize($rows)) ?>">delete</a></td>
67
68     </tr>
69     //dont remove
70   }
71 </table>
72 <a href="addwagon.php?rakeno=<?php echo $olddata?>&shipname=<?php echo $shipname?>">add wagons</a>
73 <a href="editrake.php?>">done</a>
74
75 </body>
```

**updatetruck.php (Bottom Instance):**

```
d: > rja > FYP > AB > code > updatetruck.php
1  <?php
2  require 'header.html';
3  $olddata = $_GET['olddata'];
4  $old = unserialize(base64_decode($olddata));
5  ?
6  <body style="text-align:center;">
7  <form action="/updateroadtable.php" method="post" autocomplete="on">
8    <table>
9      <tr>
10        <td>Clearing Agent: </td>
11        <td><input type="text" id="clearingagent" name="clearingagent" value=<?php echo $old['ClearingAgent']; ?>></td>
12      </tr>
13      <tr>
14        <td>Bility Name: </td>
15        <td><input type="text" id="bilityname" name="bilityname" value=<?php echo $old['BilityName']; ?>></td>
16      </tr>
17      <tr>
18        <td>Bility Number: </td>
19        <td><input type="text" id="bilityno" name="bilityno" value=<?php echo $old['bilityno']; ?>></td>
20      </tr>
21      <tr>
22        <td>Loading Date:</td>
23        <td><input type="date" id="date" name="date" value=<?php echo $old['Loadingdate']; ?>></td>
24      </tr>
25      <tr>
26        <td>Vehicle Number: </td>
27        <td><input type="text" id="vehicleno" name="vehicleno" value=<?php echo $old['vehicleno']; ?>></td>
28      </tr>
29      <tr>
30        <td>Weight (M.T):</td>
31        <td><input type="text" id="weight" name="weight" value=<?php echo $old['Weight']; ?>> readonly</td>
32      </tr>
33      <tr>
```

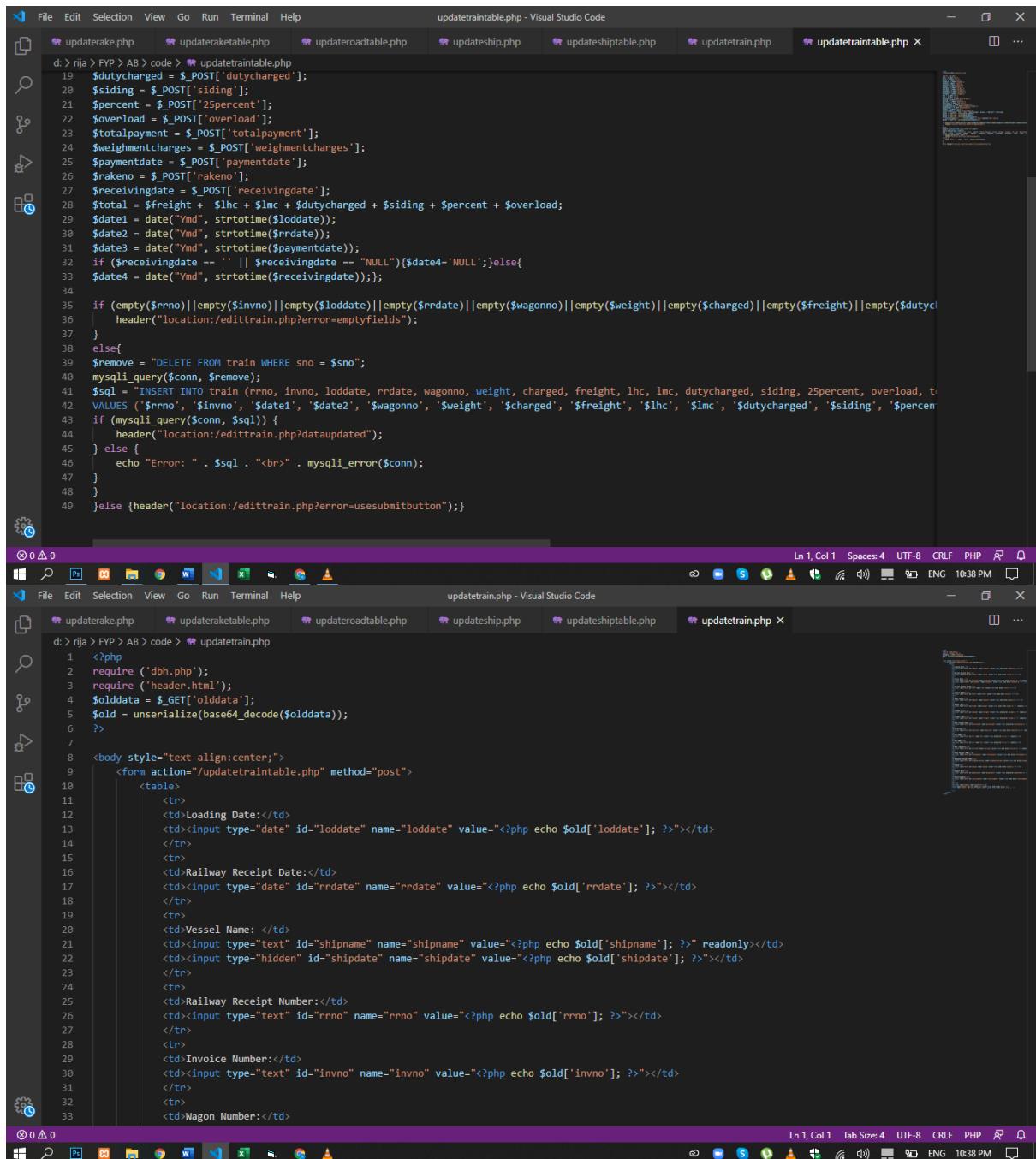
## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement



The screenshot shows two tabs open in Visual Studio Code:

- updatetruck.php - Visual Studio Code**:  
A PHP form for updating truck details. It includes fields for Rate (per M.T), Loading Point, Destinaton, Vessel Name, Receiving Date, Freight, and a Submit button. Hidden inputs include coalcategory, vesselname, and sno.
- updatetrainable.php - Visual Studio Code**:  
A PHP script for updating trainable data. It processes POST data to calculate various charges and totals. It uses variables like \$sno, \$rno, \$invno, \$lodate, \$rrdate, \$wagonno, \$sweight, \$charged, \$shipdate, \$shipname, \$freight, \$lhc, \$lmc, \$dutycharged, \$siding, \$percent, \$overload, \$totalpayment, \$weightmentcharges, \$paymentdate, \$rakeno, \$receivingdate, and \$date1-\$date4. It also handles date calculations using strtotime and date functions.

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

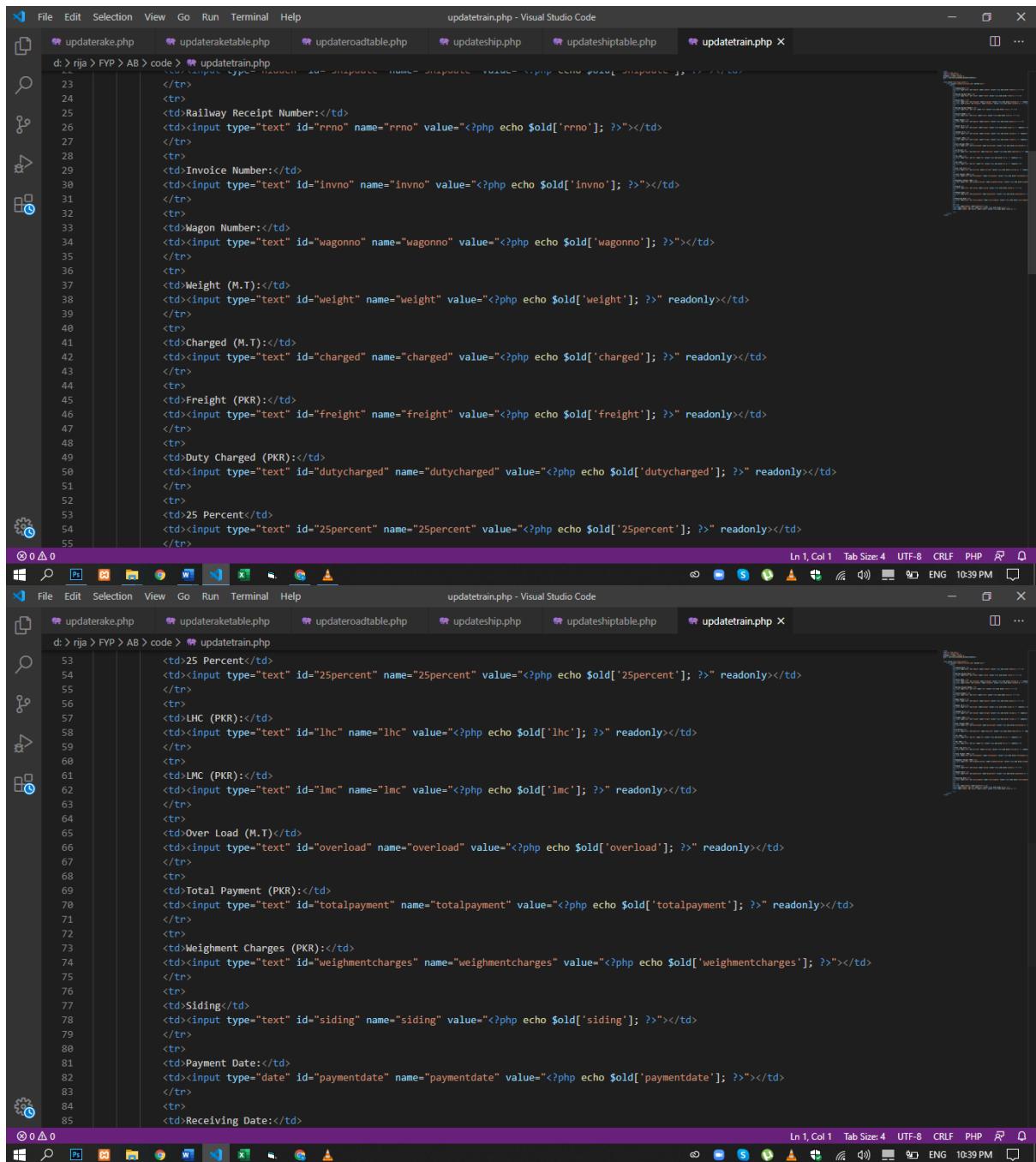


The image shows three side-by-side instances of Microsoft Visual Studio Code (VS Code) running on a Windows operating system. Each instance has a dark theme and displays a different PHP script:

- Top Window:** The title bar says "updatetrainable.php - Visual Studio Code". It contains PHP code for updating a database table named "train". The code includes variable declarations for \$rno, \$invno, \$lmc, \$lhc, \$dutycharged, \$percent, \$overload, \$totalpayment, \$weightmentcharges, \$paymentdate, \$rakeno, \$receivingdate, \$date1, \$date2, \$date3, \$date4, and \$remove. It uses MySQLi queries to insert data into the "train" table and delete rows from it.
- Middle Window:** The title bar says "updatetrain.php - Visual Studio Code". It contains PHP code for updating a database table named "train". The code includes variable declarations for \$rno, \$invno, \$lmc, \$lhc, \$dutycharged, \$percent, \$overload, \$totalpayment, \$weightmentcharges, \$paymentdate, \$rakeno, \$receivingdate, \$date1, \$date2, \$date3, \$date4, and \$remove. It uses MySQLi queries to insert data into the "train" table and delete rows from it.
- Bottom Window:** The title bar says "updatetrainable.php - Visual Studio Code". This window appears to be identical to the top one, showing the same PHP code for updating the "train" table.

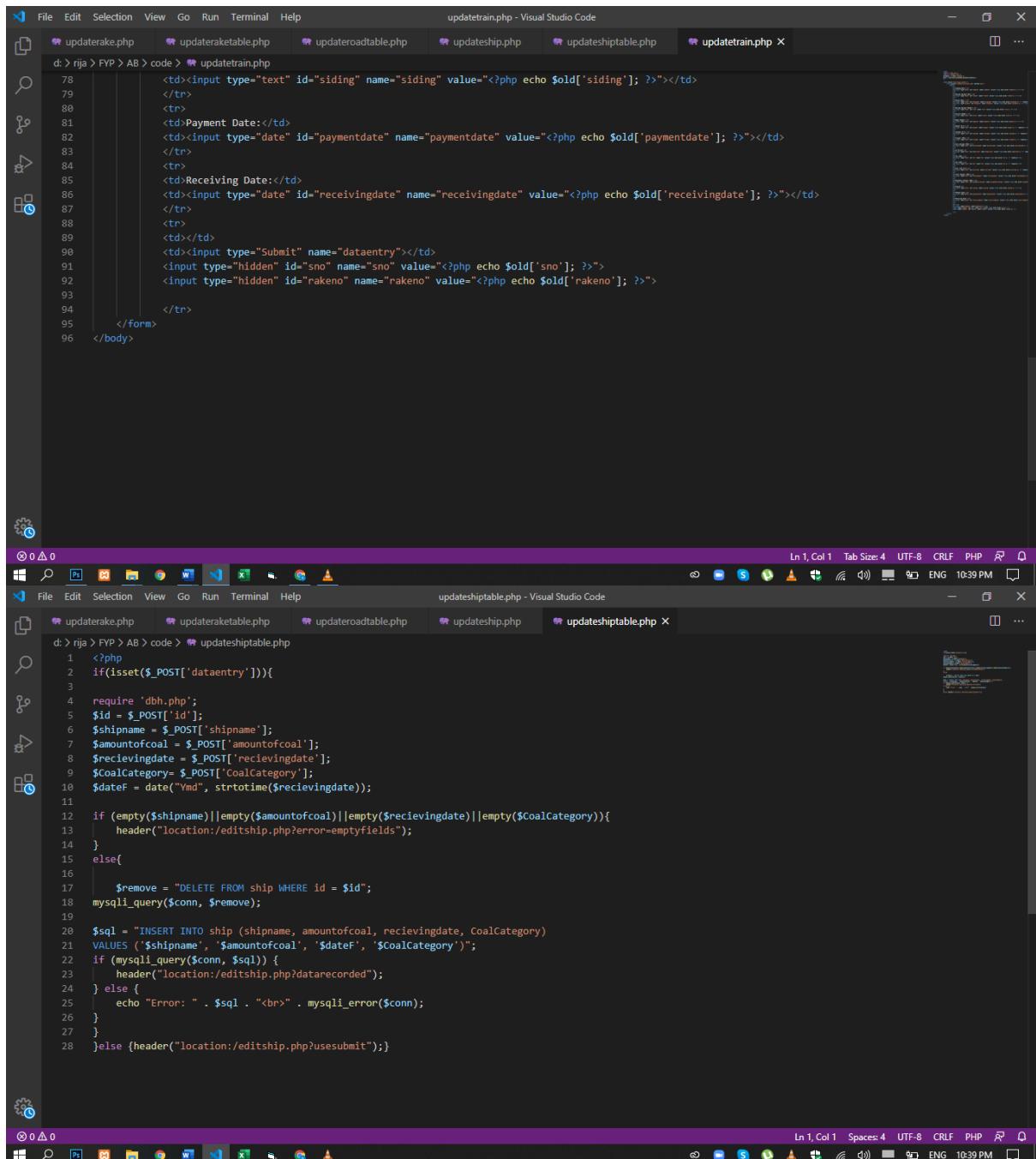
The status bar at the bottom of each VS Code window shows the following information: "Ln 1, Col 1", "Spaces: 4", "UTF-8", "CRLF", "PHP", and the current time "10:38 PM".

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement



```
d: rja > FYP > AB > code > updatetrain.php
23
24
25
26 <td>Railway Receipt Number:</td>
27 <td><input type="text" id="rrno" name="rrno" value=<?php echo $old['rrno']; ?></td>
28
29
30 <td>Invoice Number:</td>
31 <td><input type="text" id="invno" name="invno" value=<?php echo $old['invno']; ?></td>
32
33 <td>Wagon Number:</td>
34 <td><input type="text" id="wagonno" name="wagonno" value=<?php echo $old['wagonno']; ?></td>
35
36
37 <td>Weight (M.T):</td>
38 <td><input type="text" id="weight" name="weight" value=<?php echo $old['weight']; ?>" readonly</td>
39
40
41 <td>Charged (M.T):</td>
42 <td><input type="text" id="charged" name="charged" value=<?php echo $old['charged']; ?>" readonly</td>
43
44
45 <td>Freight (PKR):</td>
46 <td><input type="text" id="freight" name="freight" value=<?php echo $old['freight']; ?>" readonly</td>
47
48
49 <td>Duty Charged (PKR):</td>
50 <td><input type="text" id="dutycharged" name="dutycharged" value=<?php echo $old['dutycharged']; ?>" readonly</td>
51
52
53 <td>25 Percent:</td>
54 <td><input type="text" id="25percent" name="25percent" value=<?php echo $old['25percent']; ?>" readonly</td>
55
56
57 <td>LHC (PKR):</td>
58 <td><input type="text" id="lhc" name="lhc" value=<?php echo $old['lhc']; ?>" readonly</td>
59
60
61 <td>LMC (PKR):</td>
62 <td><input type="text" id="lmc" name="lmc" value=<?php echo $old['lmc']; ?>" readonly</td>
63
64
65 <td>Over Load (M.T)</td>
66 <td><input type="text" id="overload" name="overload" value=<?php echo $old['overload']; ?>" readonly</td>
67
68
69 <td>Total Payment (PKR):</td>
70 <td><input type="text" id="totalpayment" name="totalpayment" value=<?php echo $old['totalpayment']; ?>" readonly</td>
71
72
73 <td>Weightment Charges (PKR):</td>
74 <td><input type="text" id="weighmentcharges" name="weighmentcharges" value=<?php echo $old['weighmentcharges']; ?>></td>
75
76
77 <td>Siding:</td>
78 <td><input type="text" id="siding" name="siding" value=<?php echo $old['siding']; ?>></td>
79
80
81 <td>Payment Date:</td>
82 <td><input type="date" id="paymentdate" name="paymentdate" value=<?php echo $old['paymentdate']; ?>></td>
83
84
85 <td>Receiving Date:</td>
```

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement



The screenshot shows three instances of Visual Studio Code side-by-side, each displaying a different PHP file:

- Top Tab:** updatetrain.php - Visual Studio Code. Contains code for updating a train record. It includes form fields for siding, payment date, receiving date, and sno/rakeno, along with hidden inputs for old values.
- Middle Tab:** updateshiptable.php - Visual Studio Code. Contains code for updating a ship record. It checks if a data entry post exists, then either updates an existing record or inserts a new one into the ship table based on POST variables.
- Bottom Tab:** updatetrain.php - Visual Studio Code. This tab appears to be identical to the top one, showing the same update train code.

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

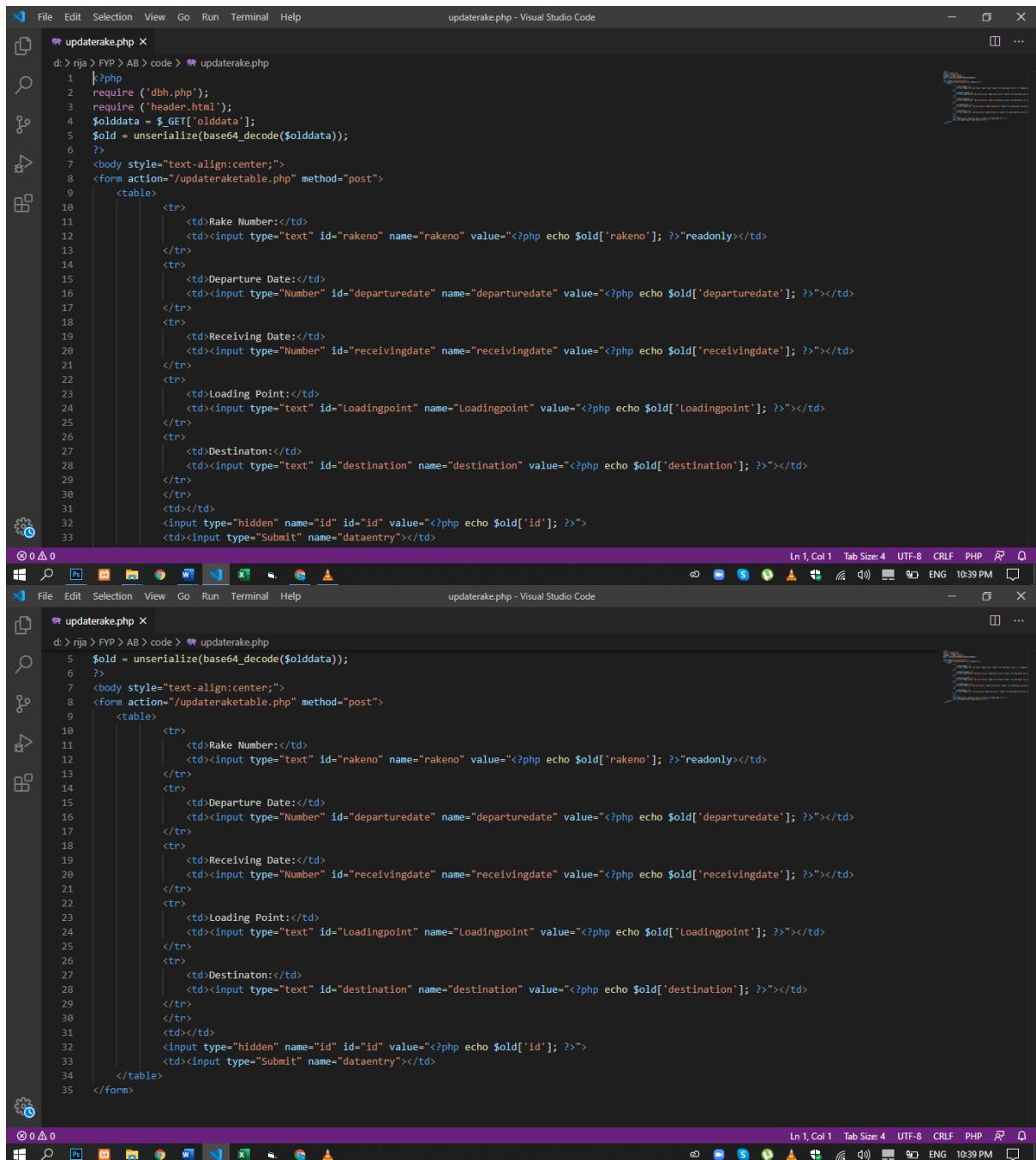
The image shows three separate instances of Visual Studio Code running side-by-side, each displaying a different PHP script for updating database tables.

- Top Window:** The title bar says "updateroadtable.php - Visual Studio Code". The code is for updating a "road" table. It includes logic to handle both update and insert operations based on whether the \$date4 variable is set. It uses MySQLi queries to update the "road" table with values from the POST array.
- Middle Window:** The title bar says "updateraketable.php - Visual Studio Code". The code is for updating a "raketable" table. It handles updates to the "railwayrake" table based on the \$id variable. It also includes logic to handle insert operations if \$date4 is not provided.
- Bottom Window:** The title bar says "updateraketable.php - Visual Studio Code". This window appears to be a duplicate of the middle one, showing the same code for updating the "raketable" table.

```
d: > raja > FYP > AB > code > updateroadtable.php
1  ?php
2  if(isset($_POST['updatedata'])){
3
4    require 'dbh.php';
5    $sno = $_POST['sno'];
6    $date = $_POST['date'];
7    $datef = date("Ymd", strtotime($date));
8    $bilityno = $_POST['bilityno'];
9    $vehicleno = $_POST['vehicleno'];
10   $weight= $_POST['weight'];
11   $ratepmt= $_POST['ratepmt'];
12   $freight = $_POST['freight'];
13   $bilityname = $_POST['bilityname'];
14   $coalcategory = $_POST['coalcategory'];
15   $clearingagent = $_POST['clearingagent'];
16   $loadingpoint = $_POST['loadingpoint'];
17   $destination = $_POST['destination'];
18   $vesselname = $_POST['vesselname'];
19   $receivingdate = $_POST['receivingdate'];
20   if ($receivingdate == '' || $receivingdate == "NULL"){$dateg='NULL';}else{
21     $dateg = date("Ymd", strtotime($receivingdate));
22   }
23
24   if (empty($date)||empty($bilityno)||empty($vehicleno)||empty($weight)||empty($ratepmt)||empty($freight)||empty($bilityname)||empty($coalcategory)
25   | header("location:/edit.php?error=emptyfields");
26   }
27   else{
28     $remove = "DELETE FROM road WHERE sno = $sno";
29     mysqli_query($conn, $remove);
30     $sql = "INSERT INTO road (Loadingdate, bilityno, Weight, vehicleno, Ratepmt, Freight, BilityName, CoalCategory, VesselName, ClearingAgent, Loading
31     VALUES ('$datef', '$bilityno', '$weight', '$vehicleno', '$ratepmt', '$freight', '$bilityname', '$coalcategory', '$vesselname', '$clearingagent',
32     if (mysqli_query($conn,$sql)) {
33       header("location:/edittruck.php?dataupdated");
34     }
35   }
36
37   if ($remove != "") {
38     mysqli_query($conn, $remove);
39     $sql = "UPDATE road SET bilityno = '$bilityno', departuredate='$datef', receivingdate=$dateg, Loadingpoint='$Loadingpoint', destination
40     mysqli_query($conn,$sql);
41     header("location:/edittruck.php?dataupdated");
42   }
43 }
```

```
d: > raja > FYP > AB > code > updateraketable.php
1  ?php
2  if(isset($_POST['dataentry'])){
3
4    require 'dbh.php';
5    $id = $_POST['id'];
6    $rakeno = $_POST['rakeno'];
7    $departuredate = $_POST['departuredate'];
8    $receivingdate = $_POST['receivingdate'];
9    $loadingpoint = $_POST['Loadingpoint'];
10   $destination = $_POST['destination'];
11   if ($receivingdate == '' || $receivingdate == "NULL"){$date4='NULL';}else{
12     $date4 = date("Ymd", strtotime($receivingdate));
13     $sql = "UPDATE railwayrake SET rakeno ='$rakeno', departuredate='$departuredate', receivingdate=$date4, Loadingpoint='$Loadingpoint', destination
14     mysqli_query($conn,$sql);
15     header("location:/editrake.php?rakedited");
16   }
17 }
```

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```
d: > raja > FYP > AB > code > updaterake.php
1 |?php
2 | require ('dbh.php');
3 | require ('header.html');
4 | $olddata = $_GET['olddata'];
5 | $old = unserialize(base64_decode($olddata));
6 |
7 |<body style="text-align:center;">
8 |<form action="/updateraketab.php" method="post">
9 |<table>
10 |<tr>
11 |<td>Rake Number:</td>
12 |<td><input type="text" id="rakeno" name="rakeno" value=<?php echo $old['rakeno']; ?>"readonly></td>
13 |</tr>
14 |<tr>
15 |<td>Departure Date:</td>
16 |<td><input type="Number" id="departuredate" name="departuredate" value=<?php echo $old['departuredate']; ?>"></td>
17 |</tr>
18 |<tr>
19 |<td>Receiving Date:</td>
20 |<td><input type="Number" id="receivingdate" name="receivingdate" value=<?php echo $old['receivingdate']; ?>"></td>
21 |</tr>
22 |<tr>
23 |<td>Loading Point:</td>
24 |<td><input type="text" id="Loadingpoint" name="Loadingpoint" value=<?php echo $old['Loadingpoint']; ?>"></td>
25 |</tr>
26 |<tr>
27 |<td>Destinaton:</td>
28 |<td><input type="text" id="destination" name="destination" value=<?php echo $old['destination']; ?>"></td>
29 |</tr>
30 |<tr>
31 |<td><input type="hidden" name="id" id="id" value=<?php echo $old['id']; ?>">
32 |<td><input type="Submit" name="dataentry"></td>
33 |
34 |</table>
35 |</form>
```

## 10. APPENDIX B

### 10.1. Project Risk Assessment

Risk Assessment is a comprehensive tool to identify the plausible risk present in a project, which might lead to disruption of progress, deviation from the timeline or may become the cause of termination of the project.

The project risk assessment was carried out to identify the risks and, to formulate the mitigation strategy.

#### 10.1.1. Rating for Impact

A legend is made to identify which risk pose greater impact and which has lesser impact.

*Table 28: Risk Assessment Legend*

<b>RISK ASSESSMENT - LEGEND</b>						
	Low	Moderate	High	Extreme		
	1 - 4	5 - 10	11 - 15	16 - 25		
<b>PROBABILITY</b>						
IMPACT		Rare (1)	Unlikely (2)	Possible (3)	Likely (4)	Most likely (5)
	Insignificant (1)	Low Risk 1	Low Risk 2	Low Risk 3	Low Risk 4	Moderate Risk 5
	Minor (2)	Low Risk 2	Low Risk 4	Moderate Risk 6	Moderate Risk 8	Moderate Risk 10
	Moderate (3)	Low Risk 3	Moderate Risk 6	Moderate Risk 9	High Risk 12	High Risk 15
	Major (4)	Low Risk 4	Moderate Risk 8	High Risk 12	Extreme Risk 16	Extreme Risk 20
	Critical (5)	Moderate Risk 5	Moderate Risk 10	High Risk 15	Extreme Risk 20	Extreme Risk 25

### 10.1.2. Risk Assessment

The risk assessment is performed to identify all possible risks associated with this project. The risk assessment along with mitigation techniques is depicted in Table below:

**Table 29: Risk Assessment**

RISK	CONSEQUENCES	OCCURANCE	IMPACT	RISK	REMEDIAL STRATEGIES
<b>INTERNAL</b>					
Unavailability of a group member due to any reason	We will lag behind our schedule	3	3	9	Following deadlines strictly and don't keep work pending for last minute
Poor communication between group members	Important information will be missed by some members	2	5	10	Regular meetings and group conversations for project-related communication
Misunderstanding project requirements	Requirements will not be fulfilled and the project will not yield satisfactory results	2	5	10	Good communication between the project team, project advisors and supervisor
The non-serious attitude of team members	The project will not be completed on time	2	5	10	Weekly assessment of the performance of each member and warning for any non-serious attitude
Disagreements between group members.	Difficulty in decision making and project plan execution.	3	4	12	Team Leader should be flexible about such issues and should resolve them quickly.

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Poor project management by the project leader	Improper execution of project plan and missing deadlines	1	5	<b>5</b>	The project leaders should be proactive and keep track of all deadlines and requirements.
Unable to fix the bugs after testing	Inefficient software	3	5	<b>15</b>	Anticipate issues before the development process to reduce the chances of errors
<b>EXTERNAL</b>					
Unavailability of data due to confidentiality	The software will be based on assumptions, therefore; it will not be effective	2	5	<b>10</b>	Effective communication with an external advisor about the availability of data and convincing him that the information is crucial for the project
The demand for expansion/changes in project scope	Increase in the complexity of the project	3	4	<b>12</b>	Define the scope and deliverables of the project after discussing with the management of the industry (or external advisor)
Major virus attack in PCs of industries	The virus will corrupt all the data	2	5	<b>10</b>	Proper data backup should be maintained and secured
User manual is difficult to understand	The employees could not handle the software	2	3	<b>6</b>	Make the user manual user friendly
Employees face difficulties in understanding software	The ERP system would not work properly	4	4	<b>16</b>	The user manual should be provided and it should be user friendly

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Transport Unavailability	Will affect the group's scheduled Industry visits	2	4	<b>8</b>	Ensure that Transport is arranged prior to a visit
Inaccurate data	Inaccurate findings	2	5	<b>10</b>	Confirm data with the advisor if results are peculiar
Errors during the collection of Data	ERP system would not give accurate results	2	3	<b>6</b>	Repeated data collection to reduce errors
<b>CONCEPT</b>					
Processes are not investigated thoroughly	Inadequate understanding of the process and inaccurate targets`	2	4	<b>4</b>	Before making final decisions, the team will use all available resources to investigate the process
Inefficient data collection plan	Improper data leading to the wrong conclusion	3	4	<b>12</b>	Proper data collection with continuous review
Inaccurate shortlisting of problem causes	Ineffective process improvement	2	3	<b>6</b>	A thorough analysis of the problem
Unachievable deliverables	Required project outcomes not achieved / industry will not be satisfied with the project	1	5	<b>5</b>	Revision of SOR
Wrong selection of concept	Results Produced will be of no value	2	4	<b>8</b>	A thorough study of Literature Required (Books, Research Papers)
<b>SCHEDULE</b>					
Unavailability of External Advisor	Quality of work will be affected	1	4	<b>4</b>	Reduce dependence on him and contact other channels

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

						from where one can get the desired information.
University classes hinder with our visits to Industry/project work	Will affect our schedule, data Collection and analysis	3	4	12	Plan better timings and make the most out of your visits/ project design periods	
Overlapping semester activities	Disturbance in routine visits	4	4	16	Gantt Chart should be made in lieu of Semester Schedule	
OTHER RISKS						
Disturbances in routine visits due to Geo-Political Situation(s) in the city	Hindrance in visiting Industry (wastage of time)	1	3	3	Plan visits by the anticipation of the situation even if it alters the previous schedule.	
Unprecedented weather conditions (Rain, Heat Stroke, etc.)	Will affect our planned Industry visits and the performance of group members	1	3	3	Make most out of the planned visits so that a day off doesn't affect the project timeline	

## 11. APPENDIX C

### 11.1. Health and Safety Risk Assessment

Health and Safety risk assessment is a critical element in a minimum and/or risk-free execution of the project. We carried out the health and safety risk assessment regarding our project to identify the associated risks. While on analysis, we find out the mitigation strategies if any of the risk takes place. It was needed so as to inform the group members of possible risk that might lead to injury during the course of this project.

#### 11.1.1. Rating for Impact

A legend is made to identify which risk pose greater impact and which has lesser impact.

*Table 30: Health and Safety Risk Assessment Legend*

<b>RISK ASSESSMENT - LEGEND</b>					
	Low	Moderate	High	Extreme	
	1 - 4	5 - 10	11 - 15	16 - 25	
<b>PROBABILITY</b>					
IMPACT		Rare (1)	Unlikely (2)	Possible (3)	Likely (4)
	Insignificant (1)	Low Risk 1	Low Risk 2	Low Risk 3	Low Risk 4
	Minor (2)	Low Risk 2	Low Risk 4	Moderate Risk 6	Moderate Risk 8
	Moderate (3)	Low Risk 3	Moderate Risk 6	Moderate Risk 9	High Risk 12
	Major (4)	Low Risk 4	Moderate Risk 8	High Risk 12	Extreme Risk 16
	Critical (5)	Moderate Risk 5	Moderate Risk 10	High Risk 15	Extreme Risk 20

#### 11.1.2. Health & Safety Risk Assessment & Mitigation Techniques

Health and Safety risk assessment was carried out regarding the course of this project and the conditions at working areas. The table below contains the assessment and mitigation techniques.

**Development of ERP Software Solution for Logistics Management of Maple Leaf Cement**  
**Table 31: Health and Safety Risk Assessment**

HAZARDS	REASON/ CONSEQUENCES	LIKELIHOOD	IMPACT	RISK	MITIGATION STRATEGY
Slip, trips, falls	<ul style="list-style-type: none"> <li>Workers, staff slipped</li> <li>Trip over lying objects</li> <li>Fall from heights</li> </ul>	3	3	9	<ul style="list-style-type: none"> <li>Arrange workplace</li> <li>Put up wet floor sign where it is wet/slippery</li> <li>PPE given to all workers</li> <li>Working instructions for working on heights</li> </ul>
Dust/coal inhalation	Workers and staff inhaling coal can create breathing problems over years	2	5	10	All workers working must wear a breathing mask
Quarrel between workers	Workers/staff can get into fight which is an unhealthy environment for them	1	4	4	Workers regulating authorities to resolve their issues.
Hit by Objects	Workers can get hit by heavy lifters, cargo or trucks	2	5	10	<ul style="list-style-type: none"> <li>Workers must wear occupational safety kits</li> <li>Danger/Be Aware signs where there is heavy cargo</li> <li>Pathways for walking around the warehouse/ working area</li> </ul>
Psychological stress	Improper sleeps or disturbed family life	3	3	9	Frequent short breaks to relax. least over time (extra working hours)
Physical exertion	Workers or staff working overtime with little rest can get exhausted leading to fainting	3	4	12	<ul style="list-style-type: none"> <li>Frequent short breaks to relax</li> <li>Shifts system rather than overtime</li> </ul>
Fire	Coal is a fuel for fire, and there is no fire safety at the warehouse/ loading area of coal currently	4	5	20	<ul style="list-style-type: none"> <li>Fire Inspection</li> <li>Fire Safety kits and training</li> </ul>
Thermal stress	This condition in workers can lead to heat exhaustion, heat rash, heat stroke, inability to concentrate etc., reducing the efficiency of workers.	4	4	16	<ul style="list-style-type: none"> <li>Monitor working conditions.</li> <li>Emergency Medical Assistance should be available all times</li> </ul>

### Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

Chemical burns	Wet concrete can cause chemical burns on human skin.	3	3	9	<ul style="list-style-type: none"> <li>• Wear proper PPEs and wash the affected area with fresh water if skin comes in contact with wet cement.</li> <li>• Seek Medical health immediately</li> </ul>
Eye, skin and respiratory tract irritation	Cement dust can cause eye, skin and respiratory tract irritations.	3	3	9	<ul style="list-style-type: none"> <li>• Use soap and water to wash off the cement dust after coming in contact with it.</li> <li>• Wear masks and other PPEs to avoid damage by cement dust.</li> <li>• Eat and drink only in dust-free areas</li> </ul>
Over exposure of UV radiations	Workers and staff working outdoor without any PPE	3	3	9	<ul style="list-style-type: none"> <li>• PPE against UV radiations Accessible shades and resting periods</li> </ul>
Dehydration	Physical exertion under the sun in hot weather can lead to dehydration that can lead to fatigue and body can lose its functionality	4	3	12	<ul style="list-style-type: none"> <li>• Access to clean water.</li> <li>• Short breaks for staff and workers to hydrate themselves</li> </ul>
Ergonomics	Awkward postures and repetitive motion can cause various musculoskeletal problems	4	4	16	<ul style="list-style-type: none"> <li>• Avoid working in awkward postures.</li> <li>• Use appropriate equipment for a job.</li> <li>• Lift properly, get help if an object is too heavy.</li> </ul>

## 12. APPENDIX D

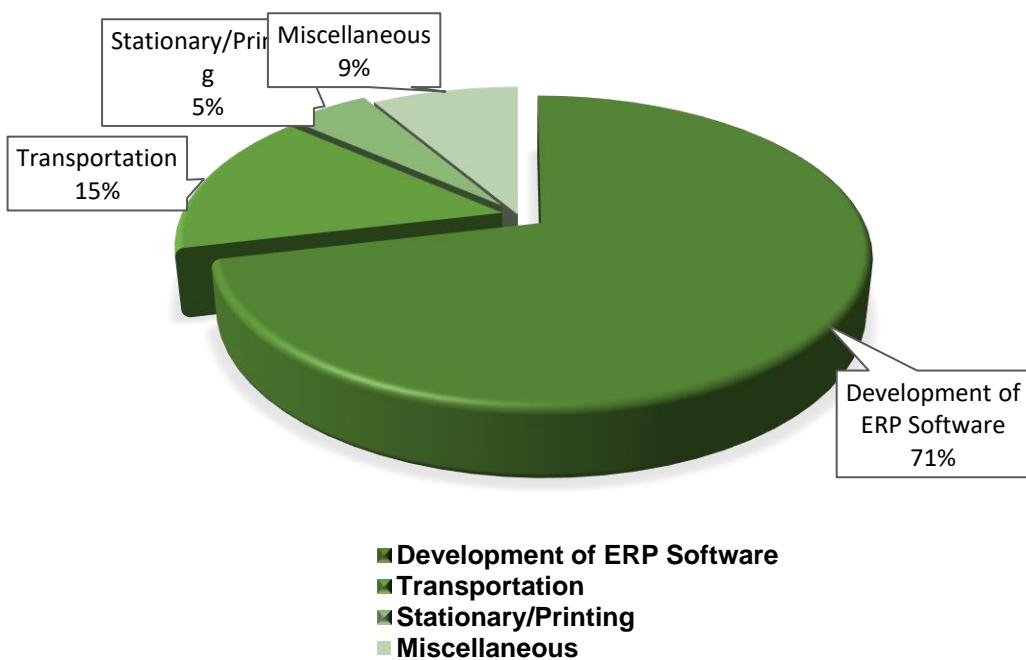
### 12.1. Project Costing

The tentative project costing has been done. Considering the possible requirements to carry out the complete project. The details are as follows;

#### 12.1.1. Budgetary Estimate

*Table 32: Budgetary Estimate of the Project*

	Categories	Frequency	Cumulative Cost
1.	Development of ERP Software	$4 \times 3 = 12$	42000/-
2.	Transportation	9	9000/-
3.	Stationary/Printing	5	2950/-
4.	Miscellaneous	-	5000/-
	Total		56950/-



*Figure 84: Cost Breakdown of the Project*

#### 12.1.2. Detailed Project Costing

The detailed costing of the project is given below:

**Development of ERP Software Solution for Logistics Management of Maple Leaf Cement**

***Table 33: Detailed Costing of the Project***

	<b>Elements</b>	<b>Category</b>	<b>Description</b>	<b>Cost</b>
<b>1.</b>	Initial Visit to industry	Transportation	The purpose of visit includes the understanding and confirmation of project	1000/-
<b>2.</b>	Project Proposal	Stationary/Printing	The Project proposal was printed and submitted to the project advisor	50/-
<b>3.</b>	Statement of Requirement	Stationary/Printing	The SOR is printed to be submitted to project advisor	100/-
<b>4.</b>	MySQL Course	Development of ERP software	The programming language is a course to develop the calculation dynamics of software	3500/per Individual
<b>5.</b>	Java Server Faces Course	Development of ERP Software	The programming language is the course to develop the back end of software	3500/ per Individual
<b>6.</b>	HTML, CSS, PHP	Development of ERP software	The programming language is a course to develop the front end of software	3500/ per Individual
<b>7.</b>	Industrial Visit	Transportation	To enhance the understanding of process plan and collect data	1000/-
<b>8.</b>	Industrial Visit	Transportation	To collect data.	1000/-
<b>9.</b>	Concept Design and Review Board Report	Stationary/Printing	The CDRB is printed to be submitted to project advisor	800/-
<b>10.</b>	Industrial Visit	Transportation	To collect data.	1000/-
<b>11.</b>	Industrial Visit	Transportation	To collect data.	1000/-

**Development of ERP Software Solution for Logistics Management of Maple Leaf Cement**

<b>12.</b>	Industrial Visit	Transportation	To test the software on field	1000/-
<b>13.</b>	Industrial Visit	Transportation	To test software on-field and amendment	1000/-
<b>14.</b>	Design Assessment Board Report	Stationary/Printing	The DAB report is printed to be submitted to project advisor	1000/-
<b>15.</b>	Industrial Visit	Transportation	To collect data.	1000/-
<b>16.</b>	Industrial Visit	Transportation	To test software on-field and debugging	1000/-
<b>17.</b>	Adjudication Board Report	Stationary/Printing	The AB report is printed to be submitted to project advisor	1000/-

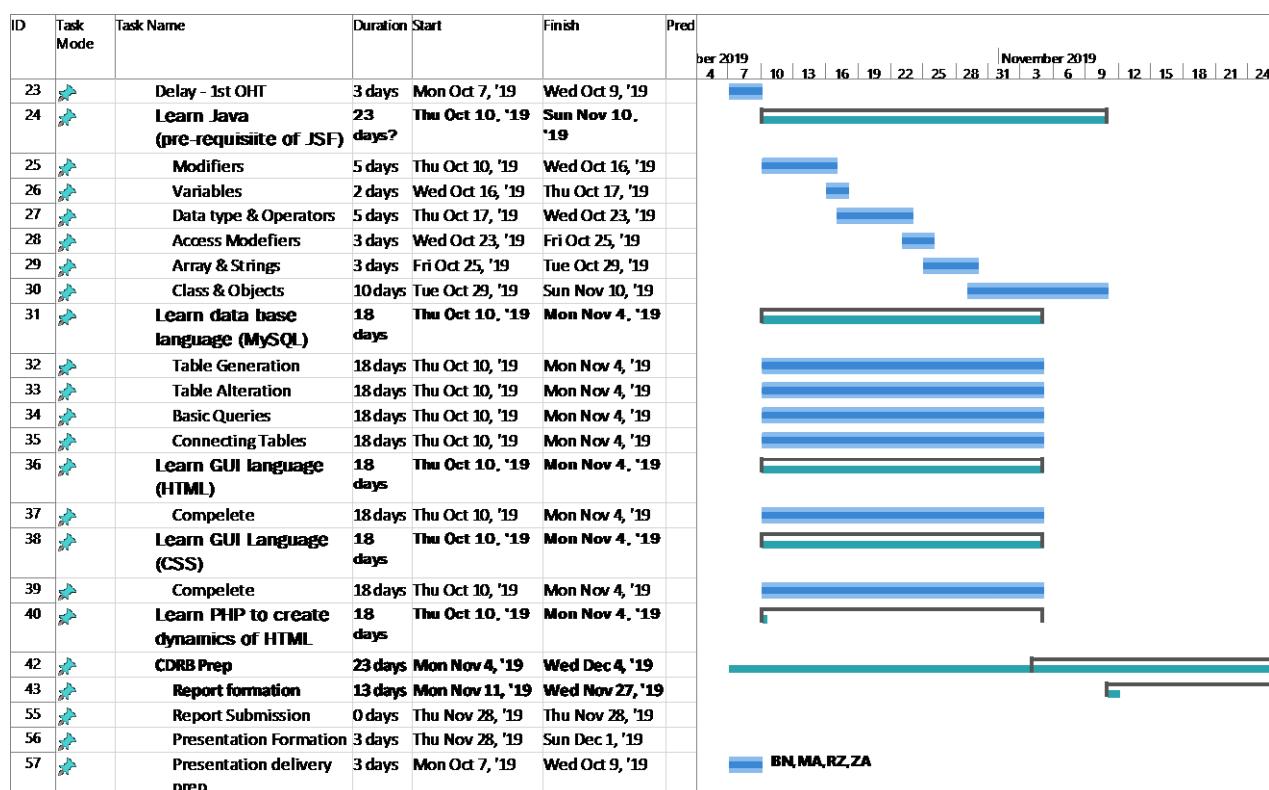
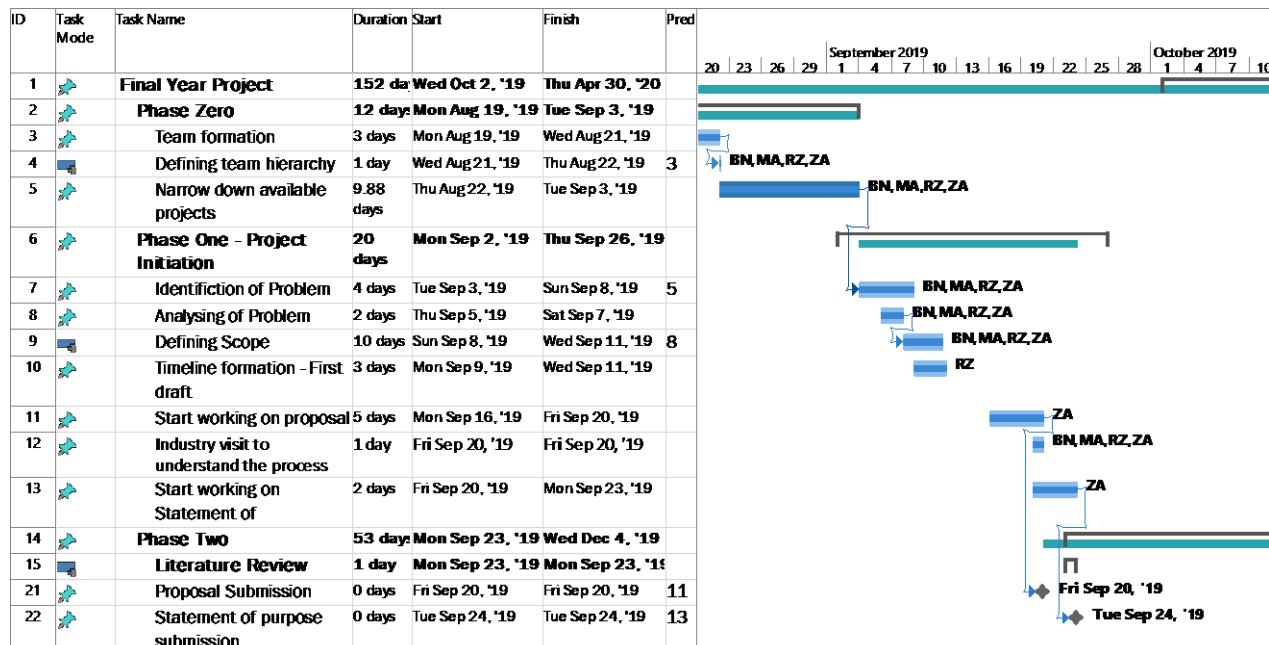
\*All prices are in PKR.

## **13. APPENDIX E**

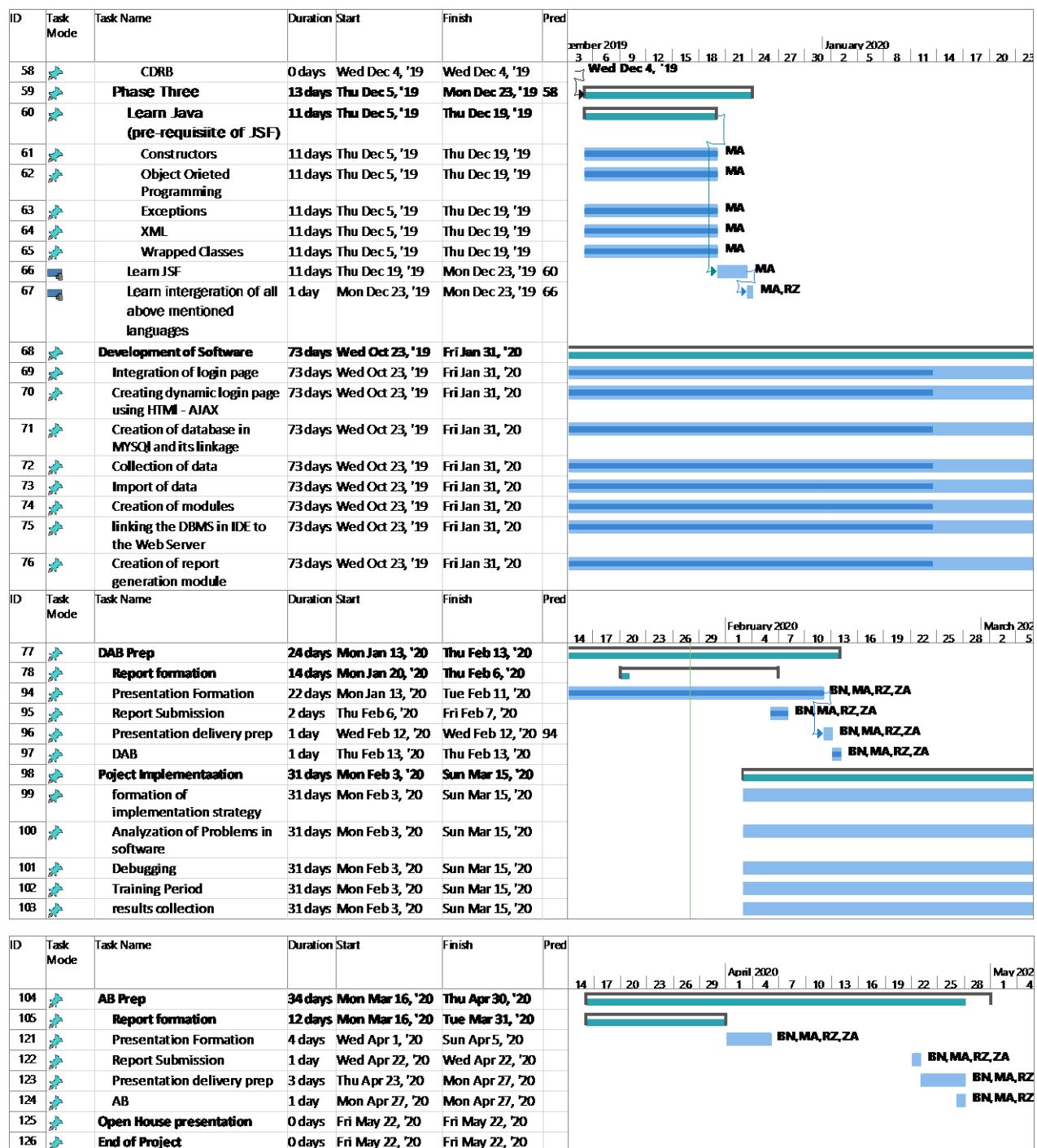
### **13.1. Project Timeline**

The project timeline was created in the end of September 2019, the project was estimated to end in April 2020. But due to unfortunate and unseen COVID-19 Pandemic has delayed everything. The institutions were closed and project was detained.

The original timeline of the project is shown in Figure below:



## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement



**Figure 85: Original Project Timeline**

## 14. APPENDIX F

### 14.1. Statement of Requirement (SOR)

<b>Title: DEVELOPMENT OF ERP SOFTWARE SOLUTION FOR LOGISTICS MANAGEMENT OF MAPLE LEAF CEMENT.</b>			<b>Issue:</b> 01	<b>Date:</b> 23-09 - 2019
CHANGES	D/W	REF	REQUIREMENTS	
		14.1.1	<b>Introduction:</b>	
		14.1.1.1	<b>Preamble</b>	
		14.1.1.1.1	Enterprise resource planning (ERP) is business process management software that allows an organization to use a system of integrated applications to manage the business and automate many back-office functions related to technology, services, and human resources. The project aims to develop an improved logistics management system using the concept of ERP (enterprise resource planning) embedded in a software application.	
		14.1.1.1.2	The project aims to develop a better logistics management system for a company "Maple Leaf Cement" using ERP embedded in a software application.	
		14.1.1.2	<b>Scope</b>	
		14.1.1.2.1	The scope of the project includes: <ul style="list-style-type: none"> <li>• Logistics report generation</li> <li>• Forecasting of material</li> <li>• Scheduling of transport</li> <li>• ERP model</li> <li>• All of the above embedded in a software application.</li> </ul>	
		14.1.1.3	<b>Related Documents</b>	
		14.1.1.3.1	<b>Books &amp; Research Papers</b>	
		14.1.1.3.1.1	Inventory management and production planning and scheduling by Edward A. Silver, David F. Pyke, and Rein Peterson	

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

		<b>14.1.1.3.1.2</b>	Operations Management by Jay Heizer & Barry Render												
		<b>14.1.1.3.1.3</b>	Fleet management issues and technology needs by Paul C. Hoffman, International Journal of Fatigue												
		<b>14.1.1.3.1.4</b>	Logistics information systems, An analysis of software solutions for supply chain co-ordination by Petri Helo and Bulcsu Szekely, University of Vaasa, Industrial Management, Vaasa, Finland												
		<b>14.1.1.3.1.5</b>	Logistics capacity management – A theoretical review and applications to outbound logistics by Große-Brockhoff, Marlies, Klumpp, Matthias, and Krome, Dirk												
		<b>14.1.1.3.1.6</b>	Vehicle Scheduling Schemes for Commercial and Emergency Logistics Integration by Xiaohui Li, Qingmei Tan												
		<b>14.1.1.3.1.7</b>	Scheduling for Modern Manufacturing, Logistics, and Supply Chains by Gerd Finke, Vitaly A. Strusevich, Frank Werner												
		<b>14.1.1.3.2</b>	<b>Software</b>												
		<b>14.1.1.3.2.1</b>	MS Office												
		<b>14.1.1.3.2.2</b>	Integrated Development Environment												
		<b>14.1.1.3.2.3</b>	Minitab												
		<b>14.1.1.3.2.4</b>	Arena												
		<b>14.1.1.4</b>	<b>Symbols</b>												
		<b>14.1.1.4.1</b>	<p>From the D/W column of this table</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;"><b>D</b></td> <td style="width: 25%; text-align: center;">Demand</td> <td style="width: 25%; text-align: center;">A</td> <td style="width: 25%; text-align: center;">mandatory requirement</td> </tr> <tr> <td><b>W(H)</b></td> <td style="text-align: center;">Wish high</td> <td style="text-align: center;">A</td> <td style="text-align: center;">highly desirable attribute</td> </tr> <tr> <td><b>W(L)</b></td> <td style="text-align: center;">Wish low</td> <td style="text-align: center;">A</td> <td style="text-align: center;">low desirable attribute</td> </tr> </table>	<b>D</b>	Demand	A	mandatory requirement	<b>W(H)</b>	Wish high	A	highly desirable attribute	<b>W(L)</b>	Wish low	A	low desirable attribute
<b>D</b>	Demand	A	mandatory requirement												
<b>W(H)</b>	Wish high	A	highly desirable attribute												
<b>W(L)</b>	Wish low	A	low desirable attribute												

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

		<b>14.1.1.5</b>	<b>Deliverables</b>
	D	<b>14.1.1.5.1</b>	Software containing three pathways tracking of raw material.
	D	<b>14.1.1.5.2</b>	Transport scheduling of raw material via software.
	D	<b>14.1.1.5.3</b>	Financial management of raw material via software.
	D	<b>14.1.1.5.4</b>	Monthly report generation.
	D	<b>14.1.1.5.5</b>	Debugging of software.
	D	<b>14.1.1.5.6</b>	Final year project report
	D	<b>14.1.1.5.7</b>	Feedback oriented software.
	W(H)	<b>14.1.1.5.8</b>	Weekly report generation option in the software.
	W(L)	<b>14.1.1.5.9</b>	Daily report generation option in the software.
	W(L)	<b>14.1.1.5.10</b>	Inventory management of raw material via software.
		<b>14.1.2</b>	<b>Technical Requirements</b>
		<b>14.1.2.1</b>	<b>Online Courses</b>
		<b>14.1.2.1.1</b>	Online short course for learning programming language.
		<b>14.1.2.2</b>	<b>Design Considerations</b>
		<b>14.1.2.2.1</b>	Supply chain planning
		<b>14.1.2.2.2</b>	Forecasting and scheduling
		<b>14.1.2.2.3</b>	Software development
		<b>14.1.2.2.4</b>	Debugging
		<b>14.1.3</b>	<b>Hazards/Safety</b>

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

	14.1.3.1	Dust inhalation of coal
	14.1.3.2	Thermal stress due to high temperature and high humidity
	14.1.3.2	Overexposure of ultraviolet radiations
	14.1.3.4	Fire hazard
	14.1.4	<b>Costs (all amounts are in PKR)</b>
	14.1.4.1	<b>Traveling costs</b>
	14.1.4.2	<b>Programming course (for 4 members)</b>
	14.1.4.3	<b>Printing cost</b>
	14.1.4.4	<b>The total cost of above-mentioned items is 56950/- PKR</b>

## 15. APPENDIX G

### 15.1. User Manual

#### 15.1.1. About this Publication

This software allows its users to record data and produce usable results in form of schedules, report and graphs.

#### 15.1.2. Intended Audience

This publication is for system operator at port, plant and warehouse

#### 15.1.3. Managing your Network from a web browser

You can manage your vast coal network using our software which provides all the primary information related to the distribution and tracking of the coal e.g. amount of coal, where and when a coal is sent.

#### 15.1.4. Starting the web application

- Go to localhost in your browser.
- Sign in to view the web application.
- Entering a valid ID will take you to a dashboard.
- The dashboard contains following information.
  - I. Pending logistics
  - II. Consignments
  - III. Reports
  - IV. Controls
  - V. Logout

Pending Logistics								
DATE	MODE	LOADING POINT	DESTINATION	VEHICLE No/WAGON NO	WEIGHT	BILTY No/RR No#	Status	Receiving
2020-06-27	road	Port Qasim	Garoni Yard	qweqeque	999999999	123123	In Progress	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-27	road	Port Qasim	Garoni Yard	12321232	155	2147483647	In Progress	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-28	train	---	KMLG Plant Daud Khel	23423	131231	234	In Progress	Received On [YYYYMMDD] <input type="button" value="Submit"/>
2020-06-28	train	---	KMLG Plant Daud Khel	1231231123	234234	12312	In Progress	Received On [YYYYMMDD] <input type="button" value="Submit"/>

#### 15.1.5. Navigating the Web

Coal-View is a browser-based interface that you can use to record data, analyze it and generate reports from it.

The interface has following parts.

##### 15.1.5.1. Consignments

The consignment module is used to enter the data for the ship which carries the coal from Africa to Karachi, the train which carries the coal from the warehouse at Garoni

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

Yard to the plant in rakes and the trucks which carry the coal from the docks to the plant.

The screenshot shows the 'Consignments' module of the Coal-View software. At the top, there's a navigation bar with links for Dashboard, Consignments, Reports, Controls, and Logout. Below the navigation bar, there are four buttons: 'By Ship', 'By Road', 'By Train', and 'Create Rake'. The main area contains a form with fields for Vessel Name, Weight In M.T., Receiving Date, and Coal Category, each with an associated input field. A 'Submit' button is located at the bottom right of the form. Below the form, a section titled 'RECORDED DATA' displays a table of historical data entries. The table has columns for Vessel Name, Weight (M.T), Receiving Date, and Coal Category. Each row includes a 'delete' link in the last column.

VESSEL NAME	WEIGHT (M.T)	RECEIVING DATE	COAL CATEGORY	
231231	21391	2020-05-06	231233232323	<a href="#">delete</a>
1233	812	2020-04-29	1342	<a href="#">delete</a>
adfafsf	0	2020-04-29	adfaf	<a href="#">delete</a>
12312	0	2020-05-20	12313	<a href="#">delete</a>

### 15.1.5.2. Reports

This button will direct you to report and analysis generated by Coal-View. Figures shown under heading “result”.

### 15.1.5.3. Controls

Control allows the user to modify and add users (if only logged in as admin), view and edit the data entered in the consignment module.

The screenshot shows the 'Controls' module of the Coal-View software. At the top, there's a navigation bar with links for Dashboard, Consignments, Reports, Controls, and Logout. Below the navigation bar, there are three input fields for User Name, Password, and Repeat Password, each with an associated input field. A 'Submit' button is located at the bottom right of the form. Below the form, a section titled 'Existing Users' displays a table of existing user accounts. The table has columns for Username, Password, and Time Created. Each row includes a 'delete' link in the last column.

Username:	Password:	Time Created:	
areeb	\$2y\$10\$NLqTzgRO.yYD1VsAqVmAXOVMQQkHW8GADMldEUYnhrl9yC1Nnw	2020-06-28 07:59:58	<a href="#">delete</a>
admin	\$2y\$10\$V7r8z3p5MsKwcPk3KXeHOWcSD8Q4i8z/X6AddyL.TmMshhQ8R0e	2020-06-28 07:48:20	<a href="#">delete</a>

### 15.1.5.4. Logout

This button logs you out of the Coal-View and takes you to the login page.

### 15.1.5.5. Results

Coal-View uses data like date, weight and freight cost to generate analytical results and report that summarizes the overall logistics of coal at MLC.

# Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

## MAPLE LEAF CEMENT FACTORY LTD

SHIP NAME: AREEB1234

### COAL RACK LOADING AND DISPATCH REPORT

VESSEL NAME	VESSEL DATE	VIA	RAKE NO	LOADING DATE	DEPARTURE DATE	DISPATCH QUANTITY(M.Tons)	NO OF WAGONS	WAGONS RECEIVED AT FACTORY
AREEB1234	2020-06-29	TRAIN	123	2020-06-29	2020-06-29	144354	2	0
AREEB1234	2020-06-29	TRAIN	1234	2020-06-29	2020-06-29	131231	1	0
						275585	3	0

SUMMARY (M.TON)	
TOTAL VESSEL :	1000
BY TRAIN:	275585
BY ROAD:	0
TOTAL DISPATCH:	275585
TOTAL REMAINING:	274395

### WAGON REPORT

S.NO	RR.#	INV#	LOADING DATE	RR DATE	WAGON NUMBER	WEIGHT	CHARGED	FREEIGHT	LHC	LNC	DUTY CHARGED	SIDING	25 PERCENT	OVERLOAD	TOTAL PAYMENT	PAYMENT DATE	WEIGHMENT CHARGE	RAKE NO	
1	1234	12312313	2020-06-29	2020-06-29	1231	13123	231231	31231	0	0	342	0	0	0	31573	0	2020-06-17	0	123
2	1234	12312323	2020-06-29	2020-06-29	123423	131231	4234	3123	0	0	13	0	0	0	3136	0	2020-07-01	0	123
3	1234	1234234	2020-06-29	2020-06-29	123423	131231	4234	3123	0	0	342	0	0	0	3465	0	2020-06-24	0	1234

### TRUCK REPORT

S.NO	LOADING DATE	BILLY NO	VEHICLE NO	WEIGHT (MLT)	RATE (per MLT)	FREEIGHT	BILLY NAME	COAL CATEGORY	LOADING POINT	DESTINATION	CLEARING AGENT
1	2020-06-29	1	TKN-1	10	100	1000	AREB	SOUTHAF	Port Qasim	KMLG Plant Daud Khet	231231

← → C ⌂ localhost/generateschedule.php
Dashboard
Consignments
Reports
Controls
Logout

MAPLE LEAF

**29th Jun 2020, Monday**  
 Coal to be sent = 1426.07 tons  
 Freight cost = 29000 PKR/-  
 Amount of duty to be paid = 285214 PKR/-  
 No. of Trucks = 29

**30th Jun 2020, Tuesday**  
 Coal to be sent = 1426.07 tons  
 Freight cost = 29000 PKR/-  
 Amount of duty to be paid = 285214 PKR/-  
 No. of Trucks = 29

**1st Jul 2020, Wednesday**  
 Coal to be sent = 1426.07 tons  
 Freight cost = 29000 PKR/-  
 Amount of duty to be paid = 285214 PKR/-  
 No. of Trucks = 29

**2nd Jul 2020, Thursday**  
 Coal to be sent = 1426.07 tons  
 Freight cost = 29000 PKR/-  
 Amount of duty to be paid = 285214 PKR/-  
 No. of Trucks = 29

**3rd Jul 2020, Friday**  
 Coal to be sent = 1426.07 tons  
 Freight cost = 29000 PKR/-  
 Amount of duty to be paid = 285214 PKR/-  
 No. of Trucks = 29

**4th Jul 2020, Saturday**  
 Coal to be sent = 1426.07 tons  
 Freight cost = 29000 PKR/-  
 Amount of duty to be paid = 285214 PKR/-  
 No. of Trucks = 29

**5th Jul 2020, Sunday**  
 Coal to be sent = 1426.07 tons  
 Freight cost = 29000 PKR/-  
 Amount of duty to be paid = 285214 PKR/-  
 No. of Trucks = 29

**6th Jul 2020, Monday**  
 Coal to be sent = 1426.07 tons  
 Freight cost = 29000 PKR/-  
 Amount of duty to be paid = 285214 PKR/-  
 No. of Trucks = 29

**7th Jul 2020, Tuesday**  
 Coal to be sent = 1426.07 tons  
 Freight cost = 29000 PKR/-  
 Amount of duty to be paid = 285214 PKR/-  
 No. of Trucks = 29

**8th Jul 2020, Wednesday**  
 Coal to be sent = 1426.07 tons  
 Freight cost = 29000 PKR/-  
 Amount of duty to be paid = 285214 PKR/-  
 No. of Trucks = 29

**9th Jul 2020, Thursday**  
 Coal to be sent = 1426.07 tons  
 Freight cost = 29000 PKR/-  
 Amount of duty to be paid = 285214 PKR/-  
 No. of Trucks = 29

**10th Jul 2020, Friday**  
 Coal to be sent = 1426.07 tons  
 Freight cost = 29000 PKR/-  
 Amount of duty to be paid = 285214 PKR/-  
 No. of Trucks = 29

**11th Jul 2020, Saturday**  
 Coal to be sent = 1426.07 tons  
 Freight cost = 29000 PKR/-  
 Amount of duty to be paid = 285214 PKR/-  
 No. of Trucks = 29

**12th Jul 2020, Sunday**  
 Coal to be sent = 1426.07 tons  
 Freight cost = 29000 PKR/-  
 Amount of duty to be paid = 285214 PKR/-  
 No. of Trucks = 29

**13th Jul 2020, Monday**  
 Coal to be sent = 1426.07 tons  
 Freight cost = 29000 PKR/-  
 Amount of duty to be paid = 285214 PKR/-  
 No. of Trucks = 29

## 16. APPENDIX H

### 16.1. Glossary

1. <b>ERP</b>	:	Enterprise Resource Planning
2. <b>WPIDC</b>	:	West Pakistan Industrial Development
3. <b>WCIL</b>	:	White Cement Industries Limited
4. <b>SCCP</b>	:	State Cement Corporation of Pakistan
5. <b>PCCL</b>	:	Pak Cement Company Limited
6. <b>OPC</b>	:	Ordinary Portland Cement
7. <b>SRC</b>	:	Sulphate Resistant Cement
8. <b>Biomass</b>	:	An organic matter used as a fuel
9. <b>MLC</b>	:	Maple leaf cement
10. <b>Embodying</b>	:	To give a tangible or visible form to (an idea)
11. <b>Debugging</b>	:	The process of identifying and removing errors from computer software
12. <b>Software Architecture</b>	:	Fundamental structures of a software system
13. <b>Non-Monolithic</b>	:	Something with small steps and incremental
14. <b>Client-Server Model</b>	:	A Web Application
15. <b>Windows Application</b>	:	An application that will run locally on that computer only with windows operating system
16. <b>Web Server</b>	:	A server software that can satisfy World Wide Web client requests
17. <b>Supercomputer</b>	:	The computer that performs at or near the currently highest operational rate for computers
18. <b>Decentralized</b>	:	Not linked with a central base but several local computers
19. <b>P2P</b>	:	Peer to peer model
20. <b>Bandwidth</b>	:	The capacity of network communications link to transmit the maximum amount of data from one point to another over a computer network
21. <b>SDLC</b>	:	Software development life cycle
22. <b>RAD</b>	:	Rapid Application Development
23. <b>DBMS</b>	:	Data Base Management System
24. <b>GUI</b>	:	Graphical User Interface
25. <b>HTTP</b>	:	Hypertext Transfer Protocol
26. <b>HTML</b>	:	Hypertext markup language
27. <b>NGINX</b>	:	A web server which can also be used as a reverse proxy, load balancer, mail proxy, and HTTP cache
28. <b>CSS</b>	:	Cascading Style Sheets
29. <b>MVC</b>	:	Model-View-Controller
30. <b>Paradigm</b>	:	A pattern or model

## Development of ERP Software Solution for Logistics Management of Maple Leaf Cement

31. **Mitigation** : The action of reducing the severity
32. **Bugs** : A problem causing a program to crash or produce invalid output
33. **Domain** : A domain name is an identification string that defines a realm of administrative autonomy, authority or control within the Internet.  
For example: [www.google.com](http://www.google.com)  
In this URL google is domain or Domain name or web domain.
34. **Doman Type** : A web domain name is a sequence of letters and/or numbers/hyphens separated by one or more periods (".") that act as a pointer to a unique numerical address (IP) on a computer network such as the Internet. (an extensions)  
For example: [www.google.com](http://www.google.com)  
In this URL .com is domain type
35. **Hosting Account** : Hosting accounts give you access to large computers, called servers, where you can store the files and information required to make a website or application.
36. **Server** : The servers connect to the internet to share and deliver that content to users
37. **URL** : A Uniform Resource Locator (URL), colloquially termed a web address, is a reference to a web resource that specifies its location on a computer network
38. **Landing Page** : A landing page is a web page that appears when a visitor clicks on a PPC ad or a search engine result link. The home page of a website is not the only landing page; every page in a website has a purpose and is a potential search engine landing page.  
In our web application, the landing page is Login page
39. **SOR** : Statement of Requirement
40. **CDRB** : Concept Design and Review Board
41. **DAB** : Design Assessment Board
42. **AB** : Adjudication Board

## 17. APPENDIX I

### 17.1. Bibliography

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