

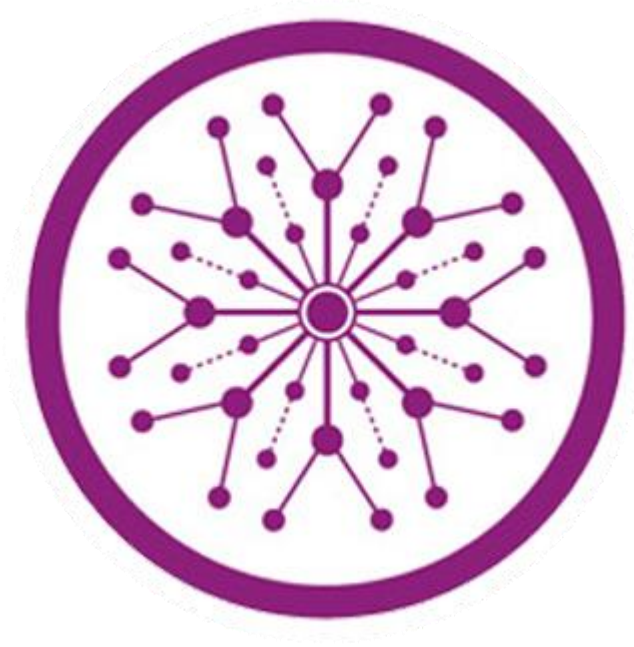
# Chem Power Engineering and Services

Final Year Project

**Session 2018-2022**

A project submitted in partial fulfillment of the degree of

BS in Computer Science



Department of Computer Science

Faculty of Computer Science & Information Technology

The Superior University, Lahore

Fall 2021

Type (Nature of project)	<input checked="" type="checkbox"/> Development <input type="checkbox"/> Research <input type="checkbox"/> R&D			
Area of specialization	Documentation and Programming			
FYP ID	FYP-BCSM-S21-006			
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\*The candidates confirm that the work submitted is their own and appropriate credit has been given where reference has been made to work of others

### Plagiarism Free Certificate

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Designation: Lecturer

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HOD: Dr. Irfan Ud Din

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# Project Report

## [Chem Power Engineering and Services]

### Change Record

Authors	Version	Date	Notes	Supervisor's Signature
Saad Bin Aamir, Raheel Asghar, Adeel Tahir	1.0	17-03-2021	Started working on the project	
Saad Bin Aamir, Raheel Asghar, Adeel Tahir	1.1	17-03-2021	Added chat bot, recommendation system and load calculator	
Saad Bin Aamir, Raheel Asghar, Adeel Tahir	1.2	18-03-2021	Was advised to add graphics type animations	
Saad Bin Aamir, Raheel Asghar, Adeel Tahir	2.0	22-03-2021	Supervisor has approved the project and advised to initiate the project through research work.	

## APPROVAL

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### PROJECT SUPERVISOR

Comments: Project approved by our supervisor after consultation.

Name: Sir Noman Jazeb

Date: 22-03-2021

Signature: \_\_\_\_\_

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### PROJECT MANAGER

Comments: Our project manager sir Jawad verified our project title by contacting supervisor and the information was verified, and our project got approved.

Date: \_\_\_\_\_

Signature: \_\_\_\_\_

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### HEAD OF THE DEPARTMENT

Comments: Project Approved!

Name: Dr. Irfan Ud Din

Date: 26-03-2021

Signature: \_\_\_\_\_

## **Dedication**

This work is dedicated to our supervisor, department, and fyp project head, because this is the best way of responding to all the hard work, our teachers had done on us. We feel, it's a time, that besides lifting our career portfolio through fyp project, it is also important for us to acknowledge all the hard work done by our teacher' guidance, which is why we are here today. We are really thankful for all the precious guidance, facility and support being provided.

## **Acknowledgements**

We are really thankful to our supervisor who has guided us really well since the start of our fyp. We faced a lot of difficulties and challenges initially while choosing title and while filling the proposals, but our supervisor provided us with timely solutions to help deal with all challenges and problems. Today, we are firmly going through all the barriers coming into our fyp, just because our supervisor is behind our back.

## Executive Summary

We have got a market project, in the form of website development for a business, that is actually providing services in 2 fields, where one is electrical and the other is chemical. In the electrical field, they are selling, repairing, and installing generators, solar panels. In the chemical field, they are selling different chemicals, as well as providing services in water treatment plants (treating industry's chemical mixed water, and freeing it up from chemical substances before disposing into rivers, to prevent ecosystem)

So, far this particular company is running a physical business and they want to expand their business by going digital. They want their services to be online, so that a large number of people use their services, all over Pakistan.

Therefore, as our fyp project, we are developing a website that would have a touch of e-commerce for the products, they are selling. We will also include an appointment form for the customers to get their repairing services and water treatment services.

We are also adding a recommendation system, which tells the users the estimated cost, for the products to be installed e.g if a customer is looking to install solar panels in a house or any property, he is not sure what would be the estimated cost, and how much panels would be needed. This is where our recommendation system would come into play. We will give him options of how many lights, fans, TV, AC, refrigerator, and many other electrical appliances needed to be run on the solar panel. The customer would choose according to his requirements and he would get the total amount in front of him, on which he could place an order by entering details. The data would be stored in our MongoDB database, and we would contact that person, after receiving the details, to proceed with the order.

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# Chapter 1

## Introduction

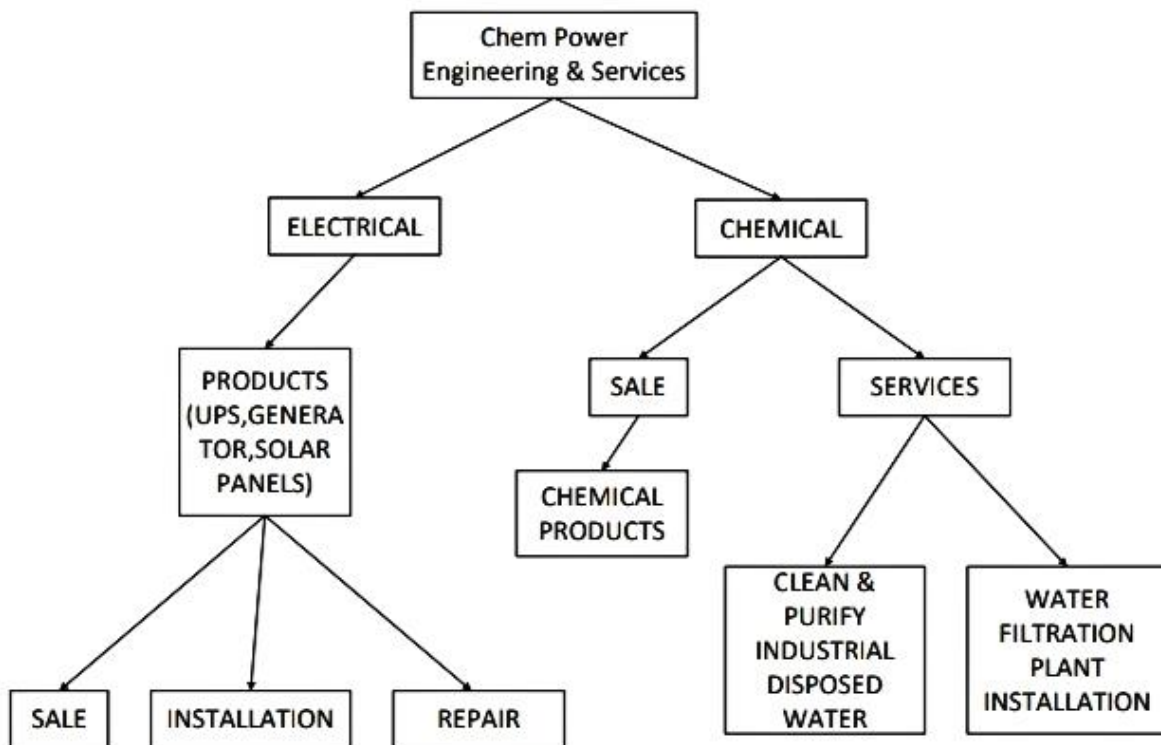
## Chapter 1: Introduction

The website that we are developing provides a digital platform to an already existing physical business. The owners desire to expand their business, by going digital and reaching out to more and more people through the internet.

Basically, they sell, repair and install electrical products like solar panels, power generators. Additionally, they also sell different chemicals, as well as treat industrial wastewater with chemical substances, and install water filtration plants.

Therefore, we are developing a website for their business. The website would be like an e-commerce store, as well as have a recommendation system integrated with load calculator, which tells customers the estimated total based on the calculated load.

A simple diagram on which our overall system is based on.



## **1.1. Background**

Basically, this is a market project for an actual business in a market. As we know that Covid has struck physical businesses badly these days, so this business was also struggling to get sales for revenue. The business owner was upset due to financial issues.

## **1.2. Motivations and Challenges**

We took their problem and challenges as a motivation to get them a reliable solution for their problem in the form of free of cost website development, as our fyp project.

They wanted to mark their business presence on an online platform through a website, for which our group has taken initiative. The online website would help them to provide their services all over Pakistan, which ultimately boost income and revenue.

## **1.3. Goals and Objectives**

Our goal is to develop a user-friendly ecommerce website that is responsive, efficient and is featured with latest functionalities like Chatbot, Load Calculator and Recommendation System. This website will not only allow users to purchase and avail various electrical products and services, but also help them to get a quote with an estimated budget based on electricity usage. For business, this website would be a great objective to add innovation in traditional working standards and ultimately a great way to digitize the business. Which means, more sales and revenue with more customers all over Pakistan.

## **1.4. Literature Review/Existing Solutions**

Right now, they are providing online services through a third-party website, which takes a commission on sales and service. Thus, having their own website is their utmost need. Besides, they are relying on their physical sales, which is quite low due to fewer customers in the market.

## **1.5. Gap Analysis**

The physical sales performance of this business is not up to the mark, or it isn't enough to support financial expenses. They are far away from their desired results of having maximum sales for comprehensive revenue. Therefore, there is a huge gap to fulfill.

## **1.6. Proposed Solution**

Develop a user-friendly website, that provides an online platform to the business, and helps to reach out to more customers digitally. Hence, more customers mean more sales and ultimately more revenue coming in. The website would come with additional features like Chatbot, Load Calculator and Recommendation System.

## **1.7. Project Plan**

Since, our fyp is of one year, so we have divided the work on a monthly basis, and this is how our project plan works. Initially, we are working on proposals, reports and documentation for our project, until fyp 1. Two members of our group are working on these proposals and documentation, while the last one is working on the prototype of the website. After completion of the prototype and documentation for this project, our main focus would be on the system designing of the project, because it would get easy for us while development when we have a complete layout and required details of the website. Work breakdown structure means, how we have divided work into smaller parts for the successful completion of our project. In this case, our project is divided into 3 parts, which include: Project management, documentation, system.

The project management includes the roles and responsibilities, the documentation includes proposals and reports, and the system part includes the development stages.

### **1.7.1. Work Breakdown Structure**

Work breakdown structure means, how we have divided work into smaller parts for the successful completion of our project. In this case, our project is divided into 3 parts, which include: Project management, documentation, system.

The project management includes the roles and responsibilities, the documentation includes proposals and reports, and the system part includes the development stages.

## 1.7.2. Roles & Responsibility Matrix

### (1) WBS deliverable: Project Management

**Activity to Complete the Deliverable:** Managing the project by making WBS, and defining roles to each member

**Duration:** 30 days

**Responsible Team Member(s) & Role(s):** Saad Bin Aamir (Managing Project by arranging meetings with supervisor and remaining in contact with the software house), Raheel Asghar (defining and dividing roles to each member)

### (2) WBS deliverable: Reports and Documentation

**Activity to Complete the Deliverable:** Making prototype, documentation, proposals, market survey, analysis and system design

**Duration:** 90 days

**Responsible Team Member(s) & Role(s):** Saad Bin Aamir (documentation, proposal), Raheel Asghar (prototyping, system layout and design), Adeel Tahir (market survey and analysis)

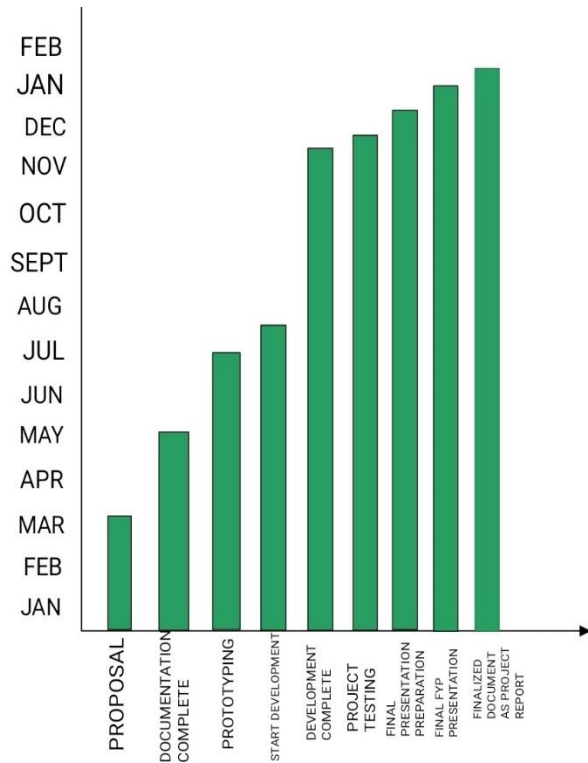
### (3) WBS deliverable: System

**Activity to Complete the Deliverable:** Designing a UI design for the website, based on different layers of working. Then develop the UI design through coding;

**Duration:** 120 days

**Responsible Team Member(s) & Role(s):** Saad Bin Aamir (React Js, HTML 5, CSS 3, Bootstrap, MongoDB, Express JS, Word Documentation/Proposal, 3D Modelling, Chatbot), Raheel Asghar (React Js, HTML 5, CSS 3, Bootstrap, MongoDB, Express JS, UI Design, 3D Modelling, Chatbot), Adeel Tahir (React Js, HTML 5, CSS 3, Bootstrap)

### 1.7.3. Gantt Chart

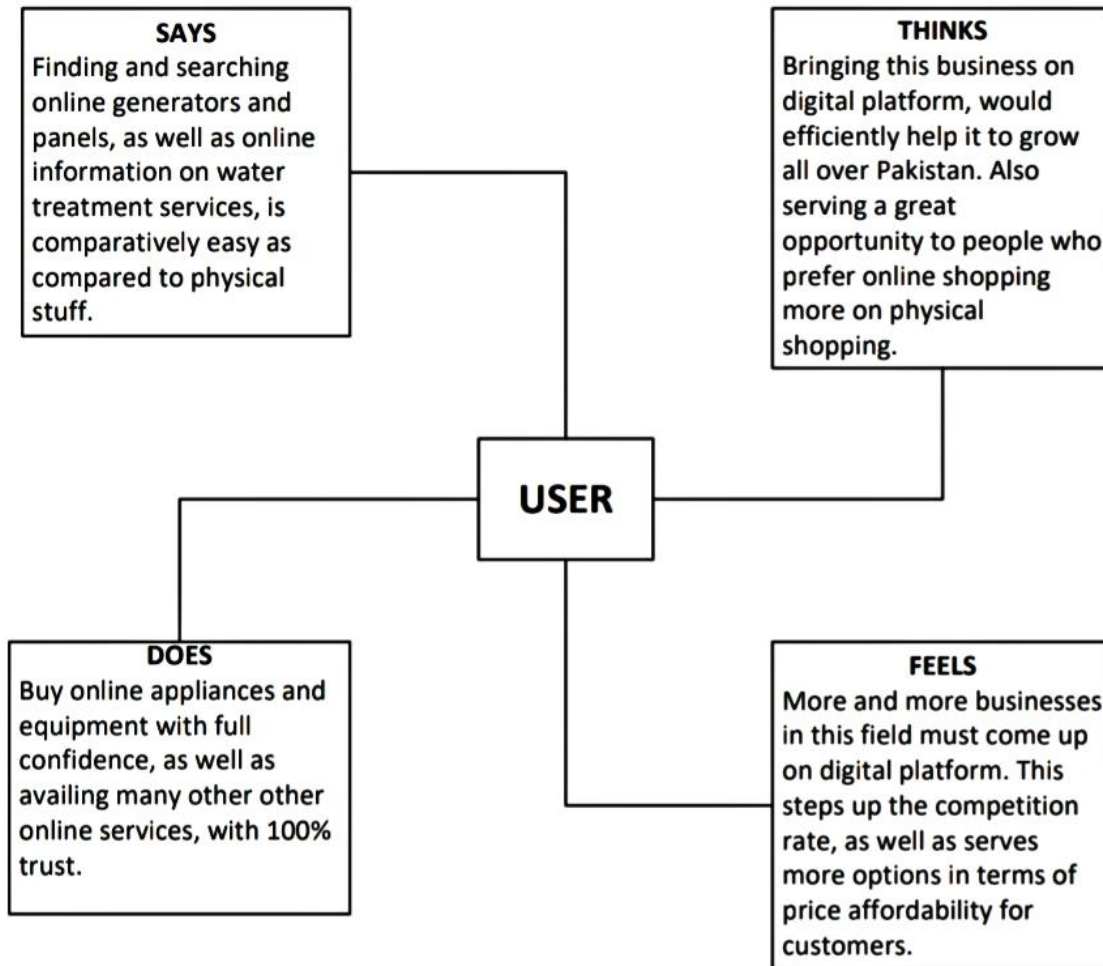


### 1.8. Report Outline

Executive summary, introduction, competitive analysis, problem statement, proposed solution, scope of the project, system architectural design, implementation tools and techniques, roles and responsibility, conclusion.

The scope of this project is that, it will provide a user-friendly interface to end-users while buying and availing services, from this business brand.

## 1.9. Empathy Map



# Chapter 2

## Software Requirement Specifications

## Chapter 2: Software Requirement Specifications

### 2.1. Introduction

#### 2.1.1. Purpose

The software specifications for this project include two modules, where one is for selling, and offering services in electrical items like solar panels, generators, and ups; whereas the second module includes selling of chemicals, as well as offering services in water chemical filtration. Now, we will work on languages like React Js, HTML 5, CSS 3, Bootstrap, MongoDB and Express JS.

The scope of this project is that, it will provide a user-friendly interface to end-users, while buying and availing services, from this business brand.

#### 2.1.2. Document Conventions

Since, our website is for two services, so we have highlighted two modules of this website: electrical and chemical. This is also what our project title is suggesting.

Moreover, following the right format is very important while creating a professional document. Similarly, in this proposal, we have also taken an initiative to strictly follow the format provided. This format includes default font size, and style. By following format, it just brings professionalism, and makes document easier to read for anyone.

#### 2.1.3. Intended Audience and Reading Suggestions

Ideally, this document is for the project manager and marketing staff. The project manager role would be to read and understand the requirements, details written in the document. Finally, develop the software for the end-user through his development team, based on provided requirements. The marketing staff would use this document as a source to convince more businesses in markets to have similar software for them as well. The reading suggestion would be to read the summary of this project initially, which summarizes the whole project in short words. The developed interest from summary would automatically take the user to read the functionalities and many other important information.

#### 2.1.4. Product Scope

The scope of this product is to digitize the physical business which not only adds efficiency, but also boosts maximum online sales by reaching out to more and more customers throughout Pakistan. The future is of e-commerce, so we also want to do our part for the e-com ecosystem.

## **2.2. Overall Description**

### **2.2.1. Product Perspective**

This is a new self-contained product, although it does possess existing system functionalities, that are picked up from competitor websites. Moreover, we will also embed additional features like a recommendation system, chatbot and load calculator.

### **2.2.2. Product Functions**

**(1) Recommendation System:** Calculate estimated cost based on requirements.

**(2) Chatbot:** Acts as a navigation guide on the website.

**(3) Load calculator:** Calculates load of the electrical appliances to be used.

### **2.2.3. User Classes and Characteristics**

#### **(1) Customer/End User**

The customer would be able to buy products like solar panels, generators and ups, at the comfort of his/her home. What's important is, the presence of a load calculator and recommendation system, would make it easy and convenient for the user to get an estimated total cost, considering his/her requirements.

#### **(2) Business Owner**

For a business owner, it would be a great thing to have a user-friendly website that records his sale and revenue, at his fingertips. He would be given a proper opportunity to serve in the e-com market, where he can easily overtake his competitors to capture the market, and enhance the brand awareness.

#### **(3) Revenue**

Revenue is extremely important for us because the more revenue we get, the better our online business is pursuing in a competitive market. Hence, also giving us chance to enhance our market, in a better way.

#### **(4) Competitors**

We have tried to make our brand, better than our competitors in the best possible way. So, our competitors are the least important factor for our product.

#### **2.2.4. Operating Environment**

This software would be operated in React and Node Js environment, while it would be connected with MongoDB as a scalable database, that helps in retrieving and receiving data.

The hardware platform for website operation would be devices connected with the internet like mobile, desktop, laptop etc. The operating system would be suitable to use on Windows, iOS and Android.

Moreover, features like recommendation system, 3D modelling, and Chatbot would also be added.

#### **2.2.5. Design and Implementation Constraints**

Client demands the website to be developed in WordPress, but we are keen on developing it on our own through languages like React and Node Js. WordPress is built-in, so we want to do much-advanced work.

Maintenance is also a real issue here, because the client has confidentiality issues, after the website goes functioning, where records or deals and payments would make the client more insecure over giving maintenance tasks to a small organization. Thus, he will choose a much reliable organization for this task, that has a good history of maintenance as well as trust with the clients.

#### **2.2.6. User Documentation**

The website is being developed in two modes, one is customer mode and the other is admin mode. The business owner would have the admin mode where he has a view of all the order processing and inventory. But for this information, we will properly train the owner by physical working as an example. Yes, guides and manuals can help but since the owner is not an IT personnel, therefore it would be better to physically train him to easily manage the admin mode.

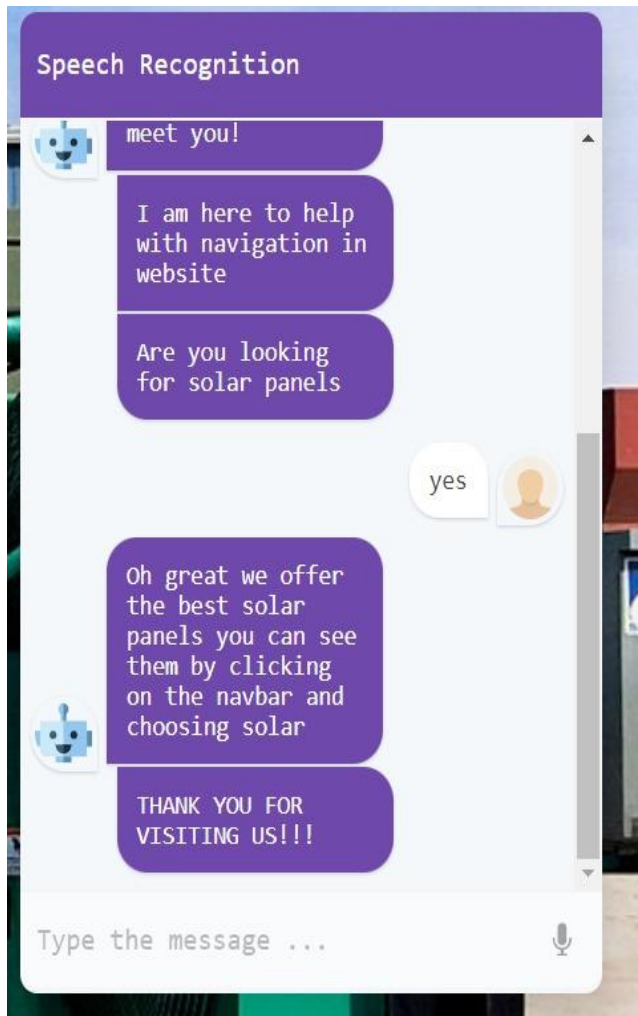
#### **2.2.7. Assumptions and Dependencies**

Taking a reference idea, information or details from our competitors is the only major external threat we are facing. Our client's ideal website is similar to the competitor, so it's important for us to take reference from it, without getting any remarks or threats for copyrights.

The external dependency is on the UI, Website pages, and layout of the competitor website. We are looking to make it similar to the competitor website, but with our touch and our additional features.







This is a UI interface of our homepage, that we have designed. Software like Figma and Adobe XD has helped in developing this UI. By considering this UI, the front end of the website would be developed.

This is drive link, that has all of our documents for UI

<https://drive.google.com/file/d/181gL6D-d68TY3IrrfBeC5rhSxPKbKTVX/view?usp=drivesdk>

### 2.3.2. Hardware Interfaces

Hardware interfaces determines the website compatibility with the devices it would execute and run on. For our website the hardware interfaces are Smartphone, Laptop, Desktop, Mac, iPad.

### **2.3.3. Software Interfaces**

The presence of MongoDB Database will help to retrieve and receive data and information, for initiating communication between user and system. The User-Friendly UI, would efficiently interact users with the system. What's important is, the presence of a Chatbot would help the users to effectively communicate with the system, which makes it easy and convenient to get information and details from the bot, which the user is searching on the website. The availability of load calculator and recommendation system offers users an estimated cost for solar panels and generators, based on electrical usage.

### **2.3.4. Communications Interfaces**

The presence of an e-mail section on the contact us page, would allow users to get in contact with the business for solutions to any of queries. The presence of Chatbot would also act as a communication interface between the user and website.

## **2.4. System Features**

(1) Recommendation System

(2) Chatbot

(3) Load Calculator

### **2.4.1. System Feature 1**

Recommendation System

#### **2.4.1.1. Description and Priority**

Calculates estimated cost based on requirements.

#### **2.4.1.2. Stimulus/Response Sequences**

Recommendation system helps recommend customer the estimated budget, according to his/her usage or requirements.

### 2.4.1.3. Functional Requirements

**Interface:** The presence of an interface for the recommendation system would allow the user to easily get quote of estimated cost based on his requirements.

**Drop-down menu:** The presence of daily usage electric items in the drop-down menu would help people to get a quote on estimated price, based on their pick in the drop-down menu in terms of power consumption related to electric items.

## 2.4.2. System Feature 2

Chatbot

### 2.4.2.1. Description and Priority

This feature helps navigate the user to his desired position on the website, by acting as a guide. And it is a high priority feature because it is the requirement of modern days website features.

### 2.4.2.2. Stimulus/Response Sequences

As the user lands on the website, the Chatbot opens up automatically for guiding and giving assistance to the user, to navigate him/her to the desired portion of the website e.g products.

### 2.4.2.3. Functional Requirements

**Interface:** The interface of the Chatbot allows users to conveniently communicate with the bot.

**Messaging box:** The messaging box in Chatbot allows users to efficiently chat with not via messages and get assistance.

## 2.4.3. System Feature 3

Load Calculator

### 2.4.3.1 Description and Priority

The load calculator helps the user in calculating his/her electrical load in the house, office, or business.

### 2.4.3.2 Stimulus/Response Sequences

The user would be able to get his electrical load by selecting from options like light bulb, fans, and daily appliances. These electrical appliances are used in daily life for the user. So, the user would be able to get total amount that is required for installation of solar panels based on electricity usage.

### 2.4.3.3 Functional Requirements

Calculates total load to give you estimate amount needed for installation of solar panels in your property.

## 2.5. Other Nonfunctional Requirements

### 2.5.1. Performance Requirements

**Performance:** The load time for the website will not be more than 1 minute. We have designed a user-friendly website that is responsive and highly efficient.

**Maintainability:** It takes less time for our website to recover after a potential system failure.

**Security:** We will secure the data of the website using an encrypted connection. Moreover, we will use HTTPS web address which is secure than HTTP. We will also install firewalls and security plugins.

**Usability:** We have developed a user-friendly website with an attractive UI and availability of Chatbot and Load Calculator.

### 2.5.2. Safety Requirements

We want to keep our website safe from all sorts of cyber-attacks. Therefore, we are embedding state of the art security system that will prevent all sorts of attacks and hacking attempts. This keeps both user and admin data, safe and secure. Our security system would comprise of encrypted connection, installation of firewalls and security plugins, use a secure host, keep website updated and regularly backup the website.

### **2.5.3. Security Requirements**

Threats and attacks are always a part of the digital world, so we are fortunate to ensure the safety of both user and business data for the website we are developing. We will secure the data of the website using an encrypted connection, and installation of firewalls and security plugins. We will apply for a Website Security Certificate. Lastly, we will use an HTTPS web address that is secure as compared to an HTTP web address.

### **2.5.4. Software Quality Attributes**

The features like portability, robustness, usability, flexibility, adaptability, and availability are associated with our project. After all, ease of use is what matters most, as the end result.

### **2.5.5. Business Rules**

Marketing is the major role in spreading awareness of any product. Therefore, our one group member is going to do On-page SEO on the website, while other will design brochures, standee etc. Our last group member will handle social media marketing.

## **2.6. Other Requirements**

When we got this project, we signed a contract with the business owner that states a strict policy on confidentiality of the product insights. Therefore, as per legal terms we are bound to follow their data privacy and standards. Ethically, this is also a role of a software developer to not misuse or leak customer's data. Henceforth, this is where we are strictly obliged to follow their rules and regulations. Importantly, we will not disappoint our client by any means.

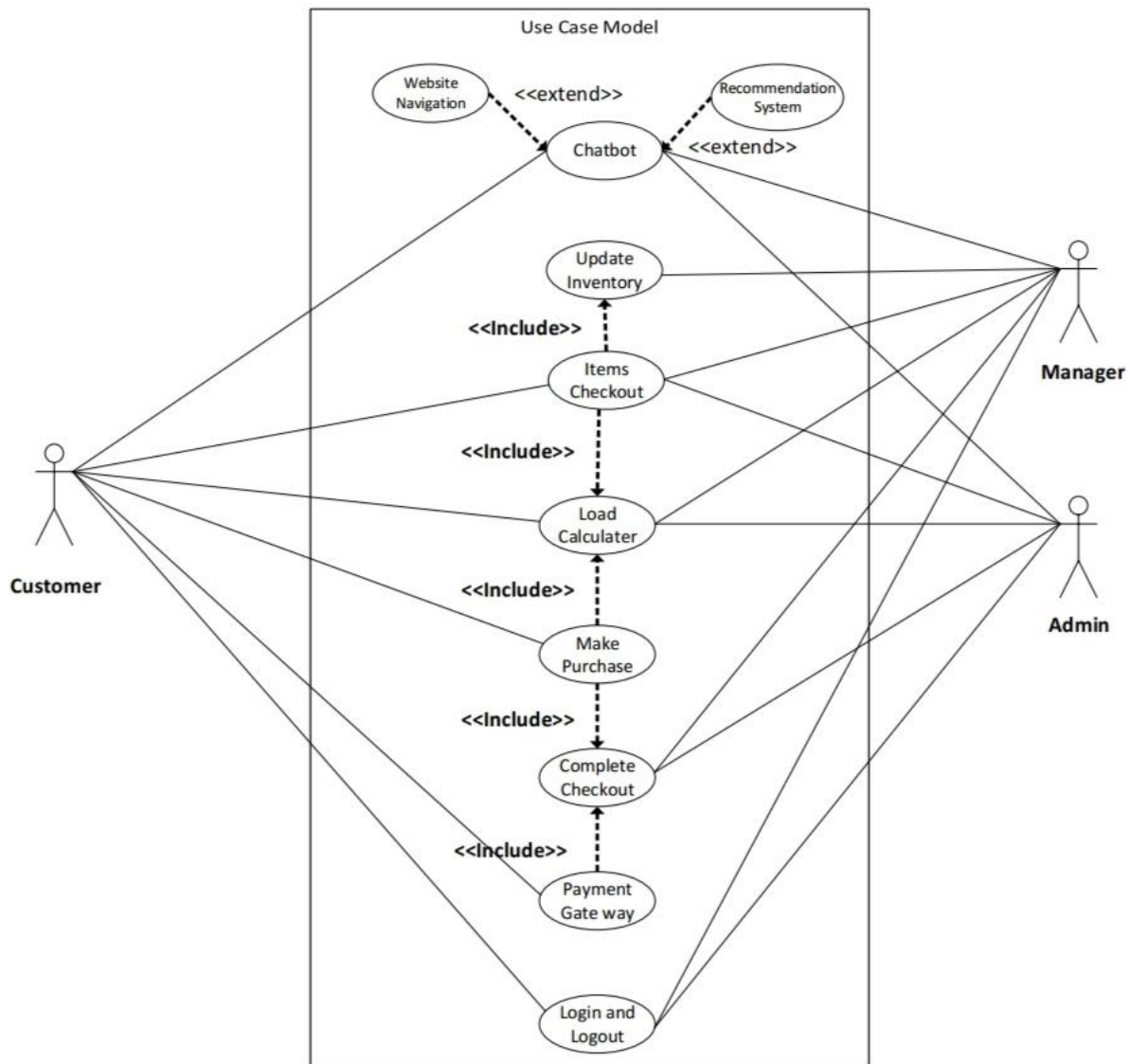
# Chapter 3

## Use Case Analysis

## Chapter 3: System Analysis

This chapter tells us about the techniques that are used to identify the requirements of information and system. It also indicates the defined processes and classes that would be used in the use cases diagram. Moreover, the overall use case in the design and development of a program is also determined.

### 3.1. Use Case Model



## 3.2. Use Case Descriptions

**Total Actors:** 3

**Primary Actor:-** Customer

**Secondary Actors:-** Admin, Manager

### **Flow of events**

- Manager updates inventory
- Admin manages that inventory by keeping record of products
- Customer visit website and navigate sections either directly or by the help of Chatbot
- The customer views electrical products
- Customer can calculate electrical load with the help of load calculator, which also provides estimated cost
- Checkout is completed and customer can continue the order with payment gateway
- Once checkout is completed both manager and admin gets a notification of placed order

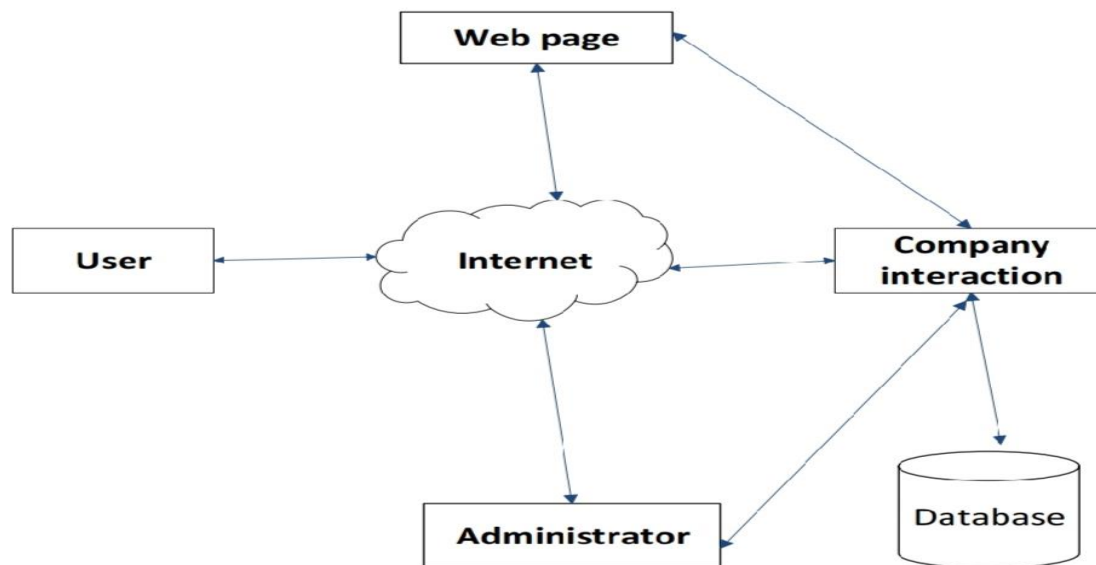
# Chapter 4

## System Design

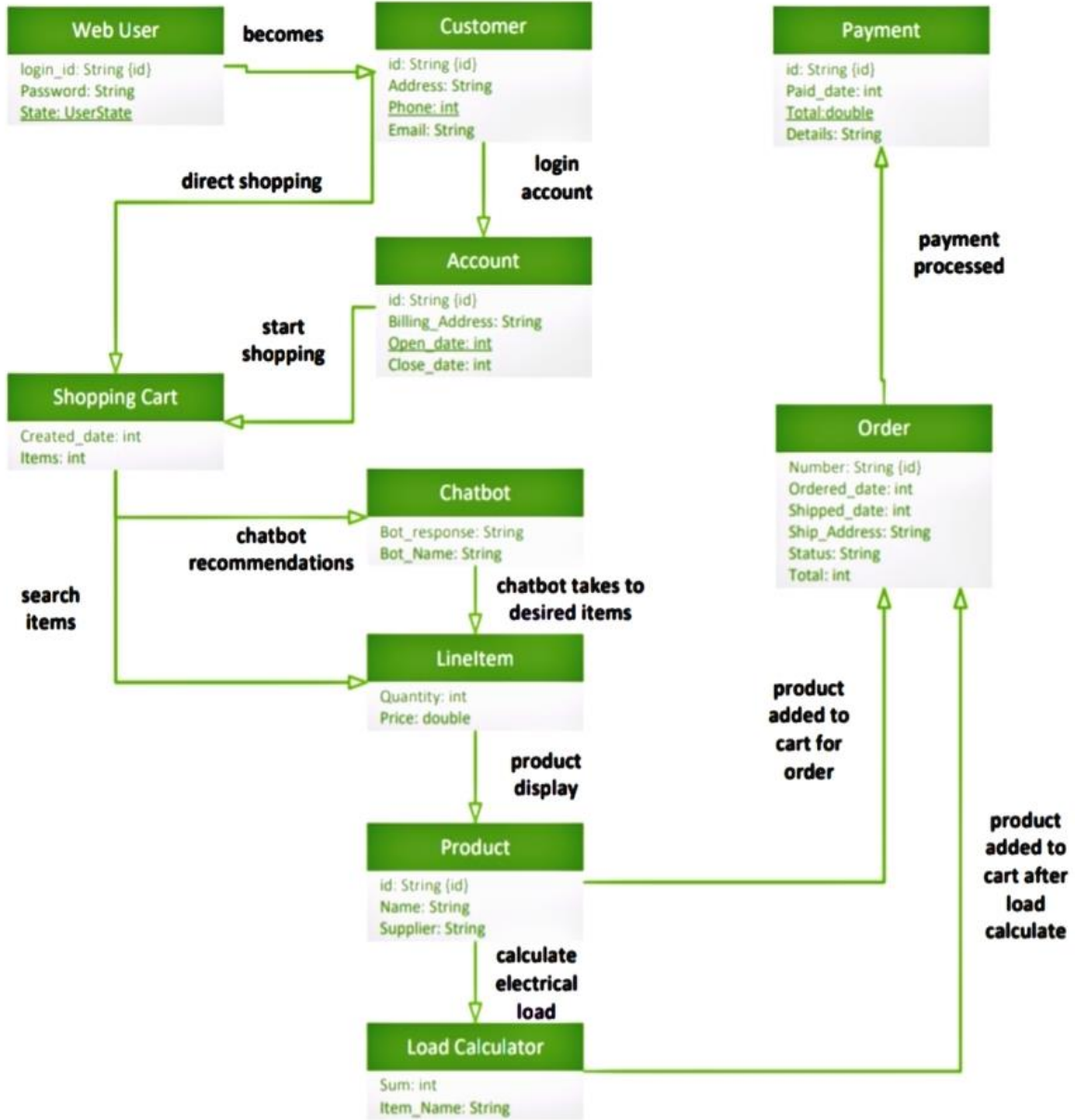
## Chapter 4: System Design

A System Design is known to be a process that defines elements of a system involving architecture, modules, components, interfaces, and data for a system based on specified requirements. It basically designs, develops and defines system to satisfy the requirements and needs of a business organization.

### 4.1. Architecture Diagram

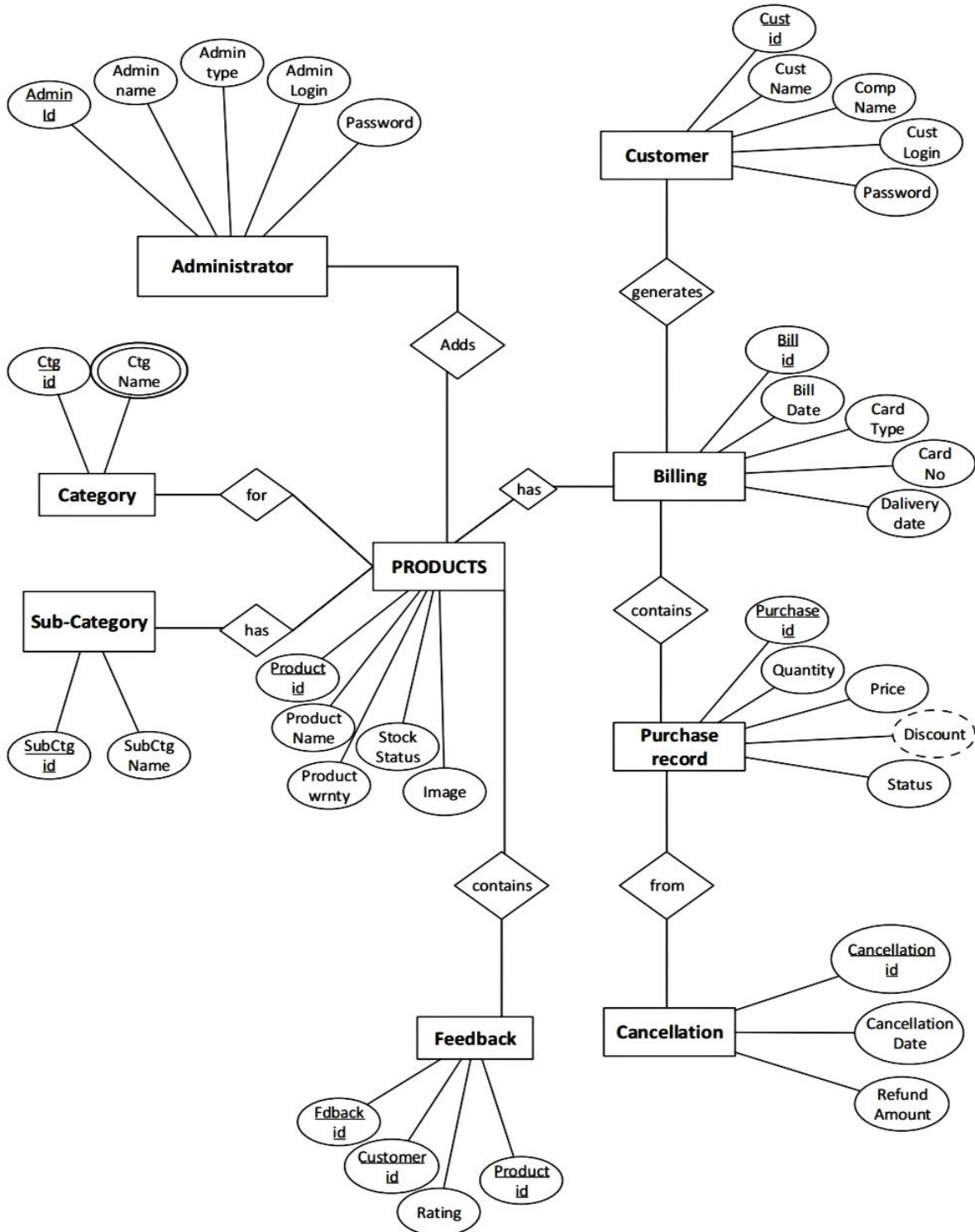


## 4.2. Domain Model

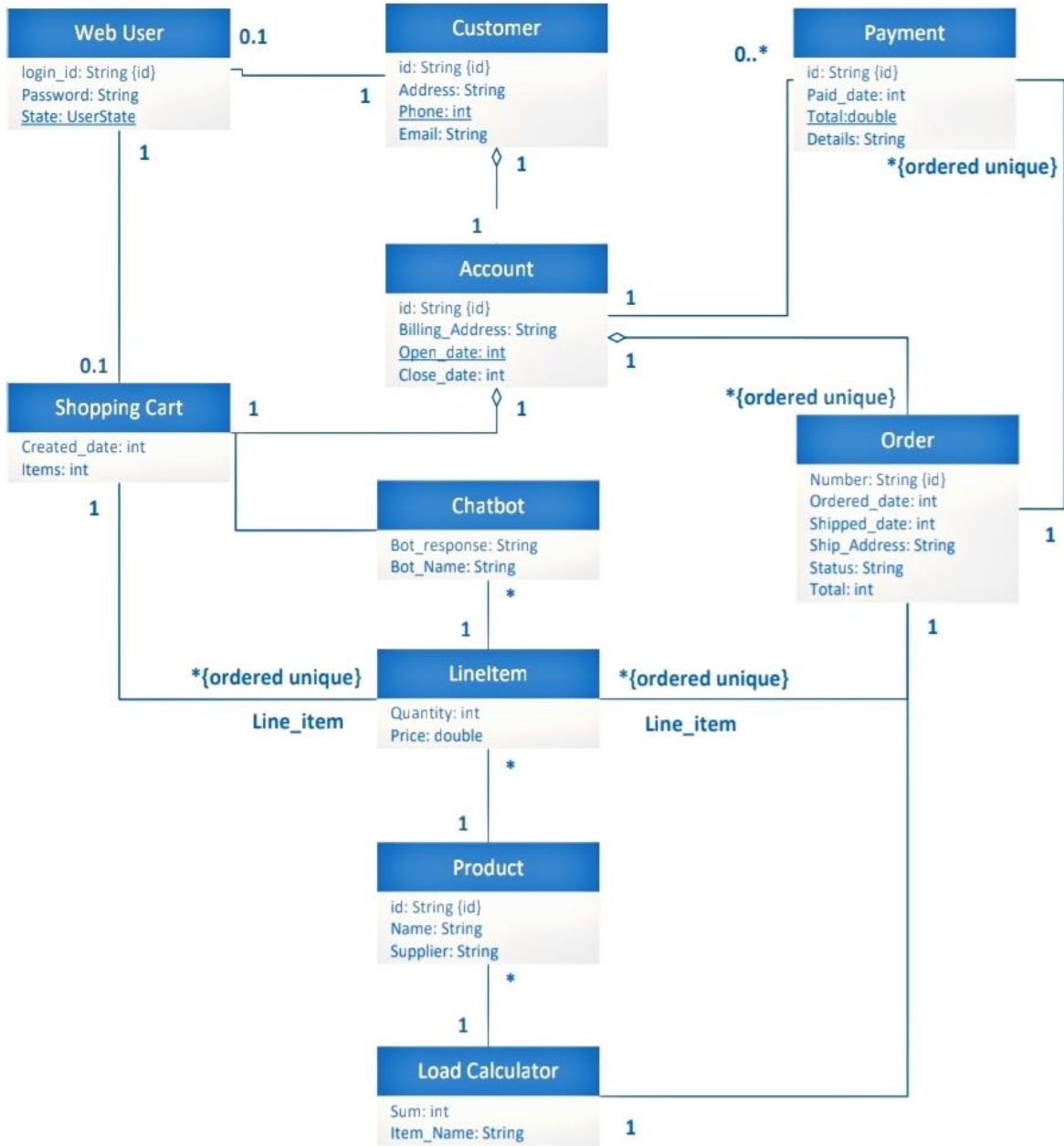


### 4.3. Entity Relationship Diagram with data dictionary

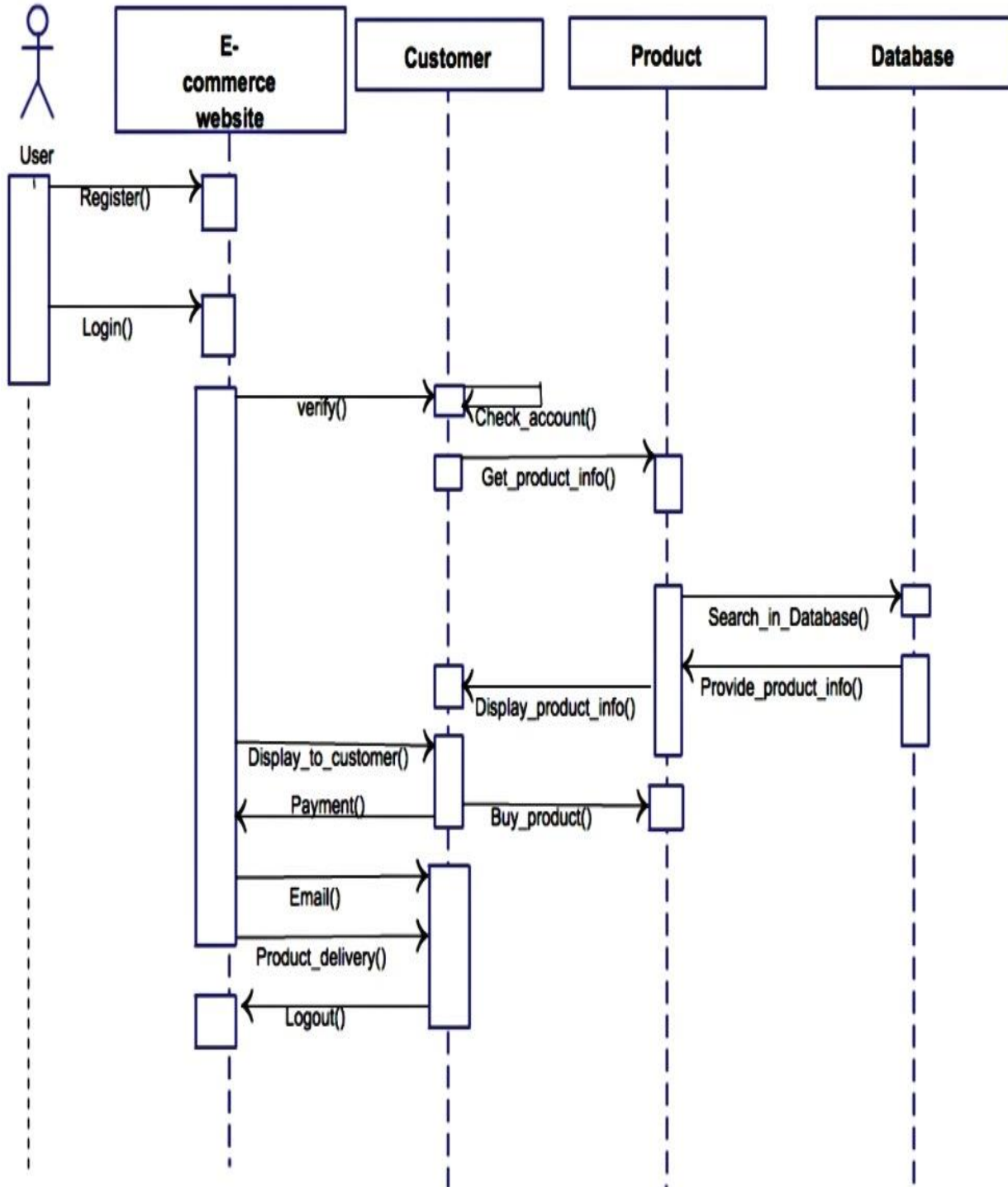
#### Chen Notation



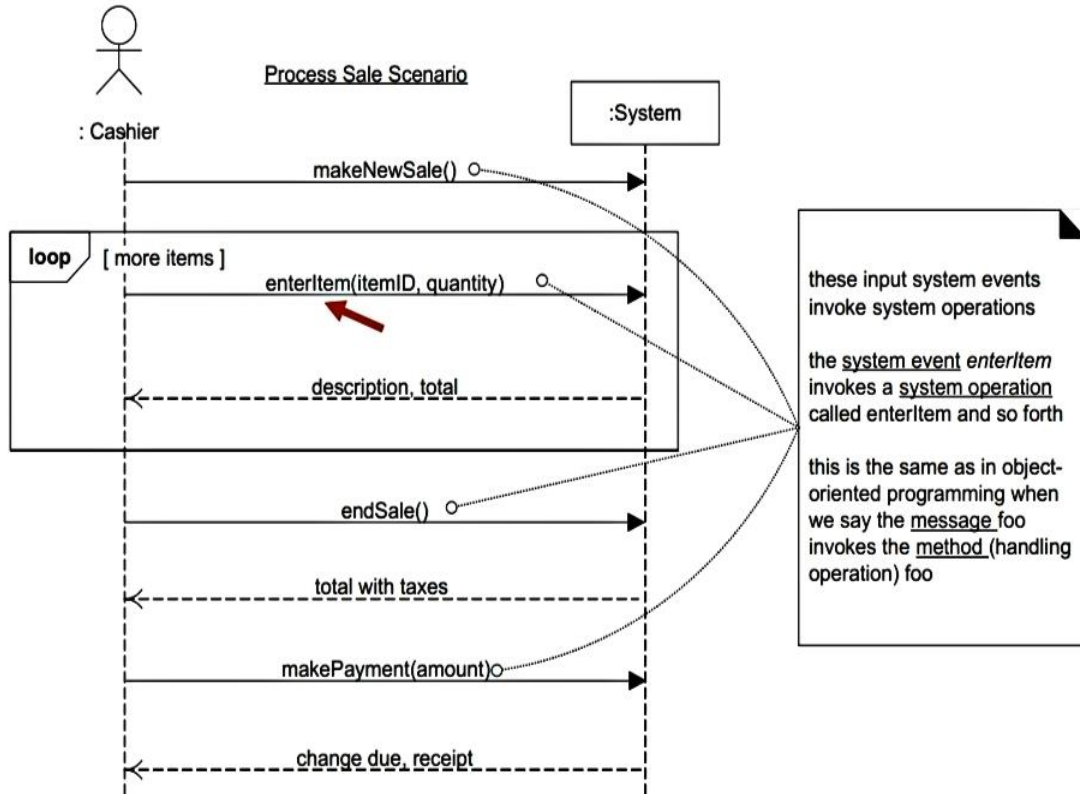
### 4.4. Class Diagram



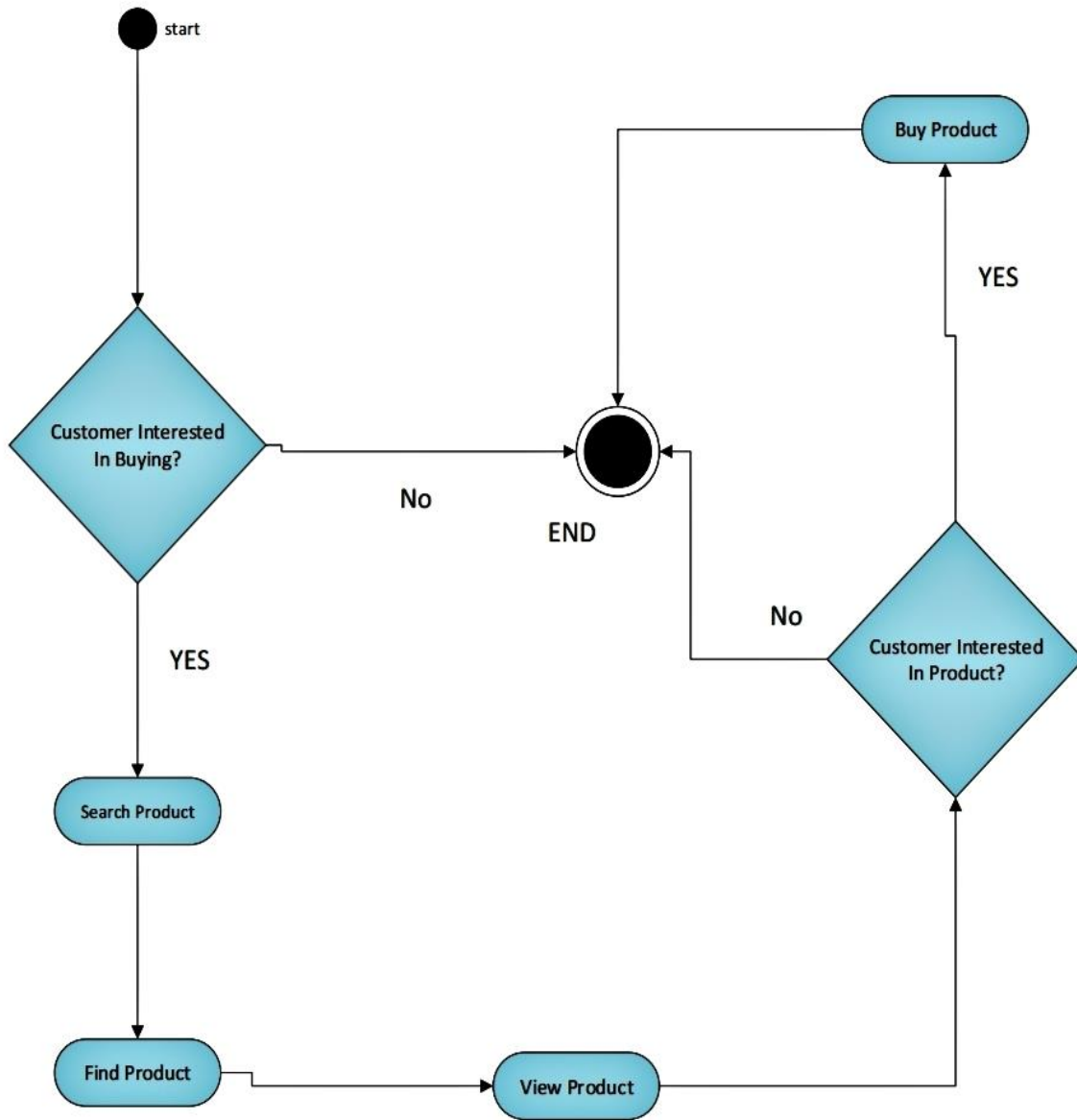
### 4.5. Sequence / Collaboration Diagram



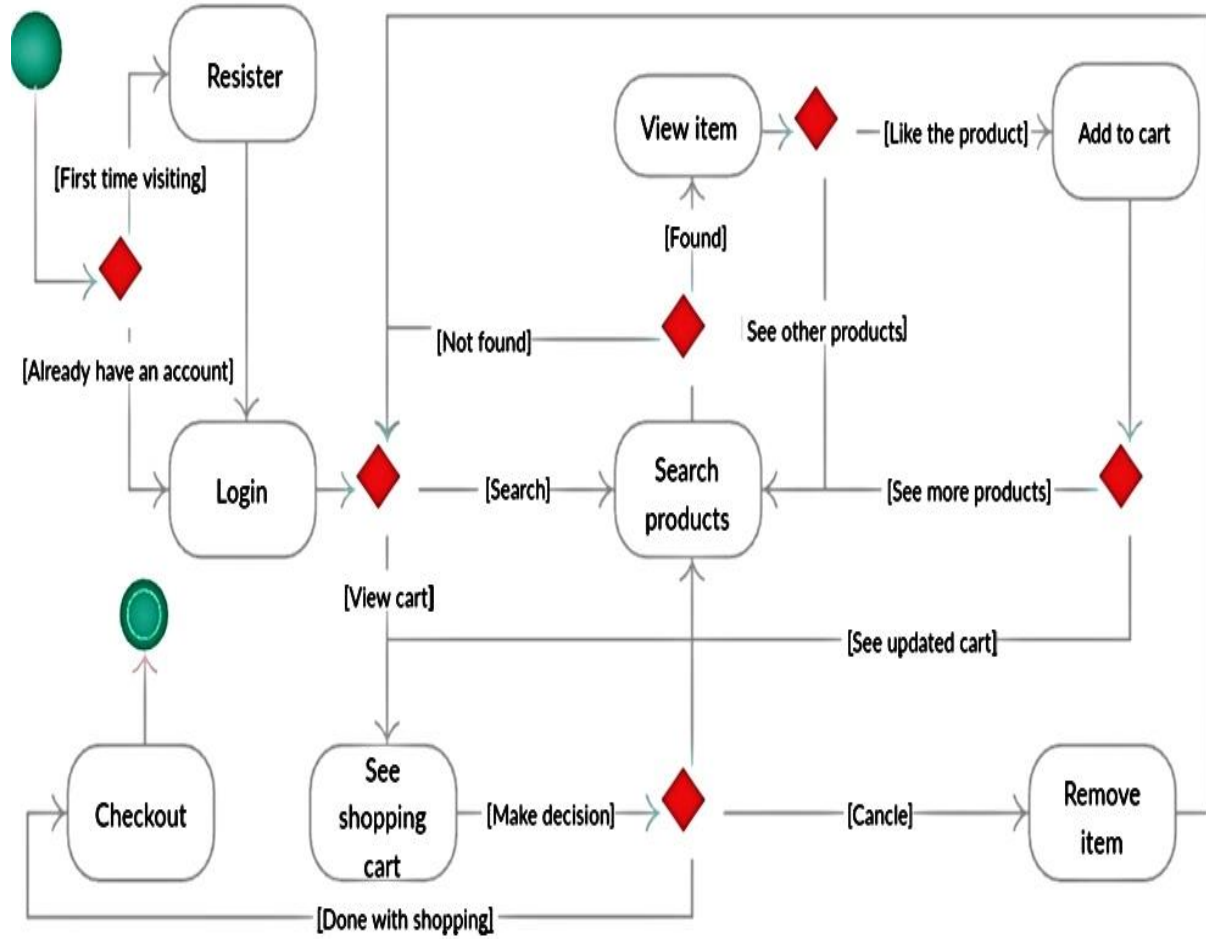
## 4.6. Operation contracts



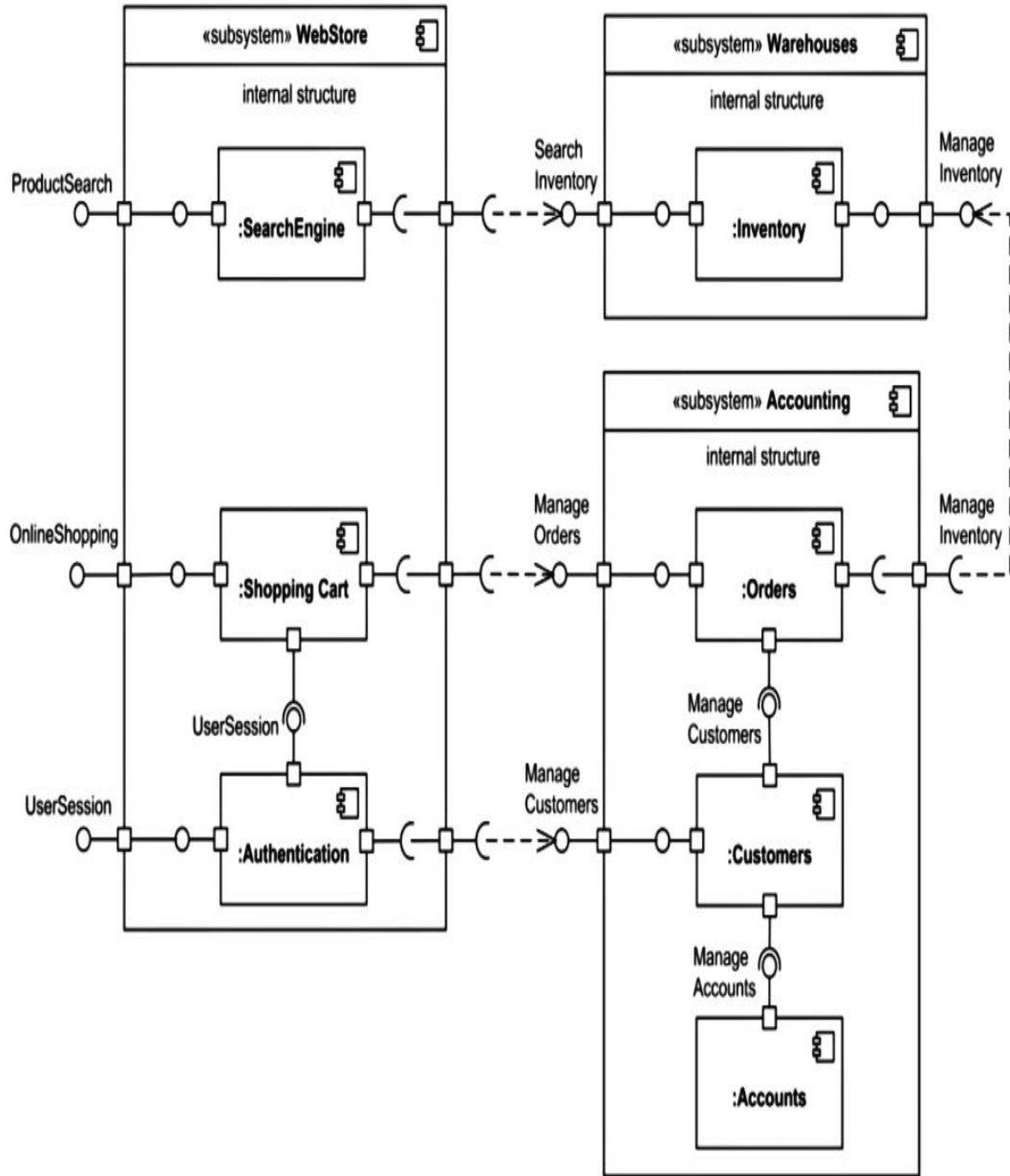
### 4.7. Activity Diagram



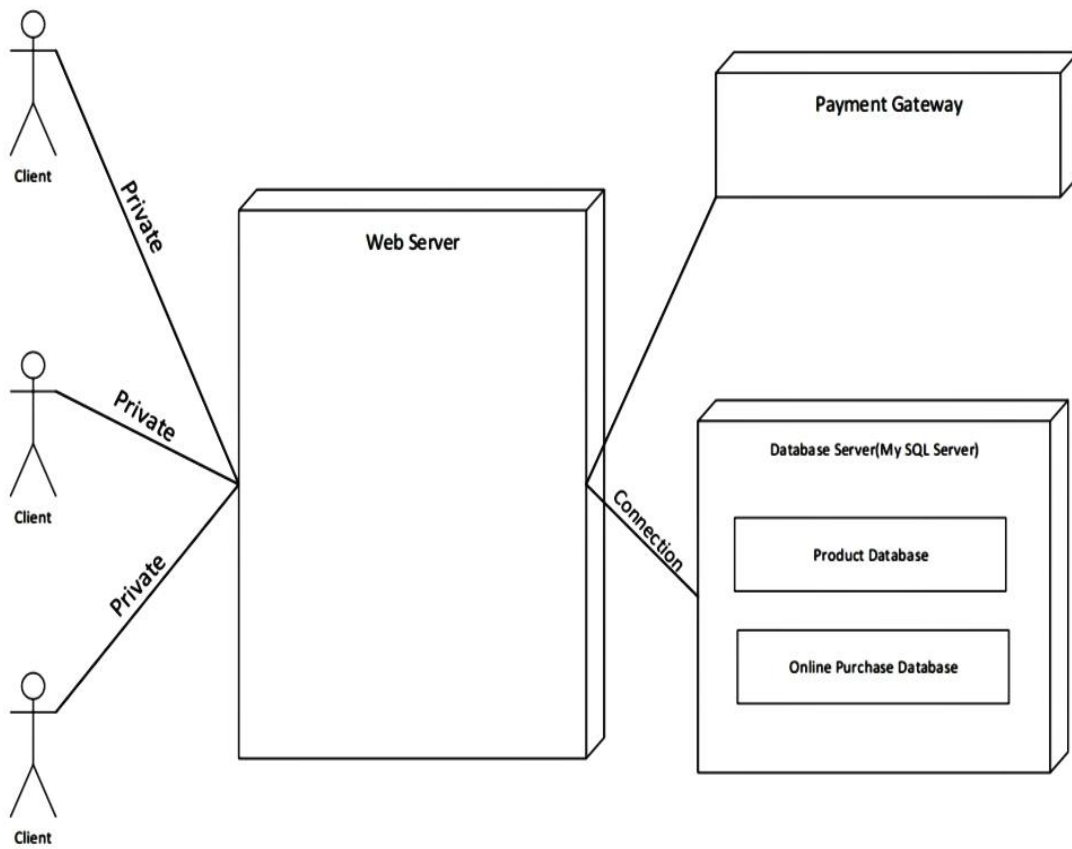
### 4.8. State Transition Diagram



### 4.9. Component Diagram

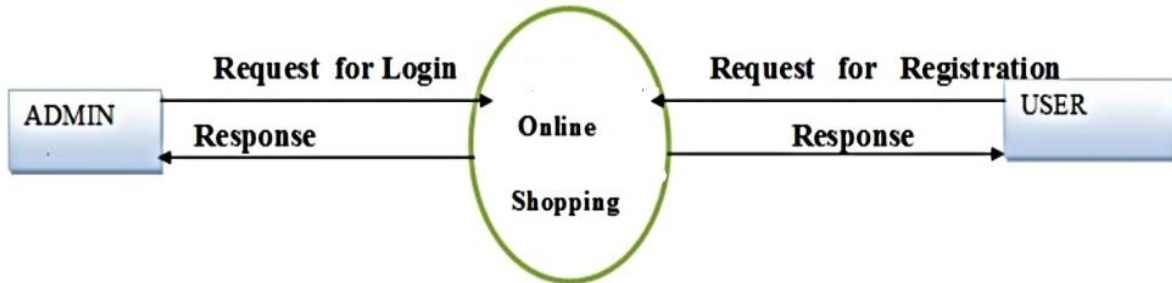


## 4.10. Deployment Diagram

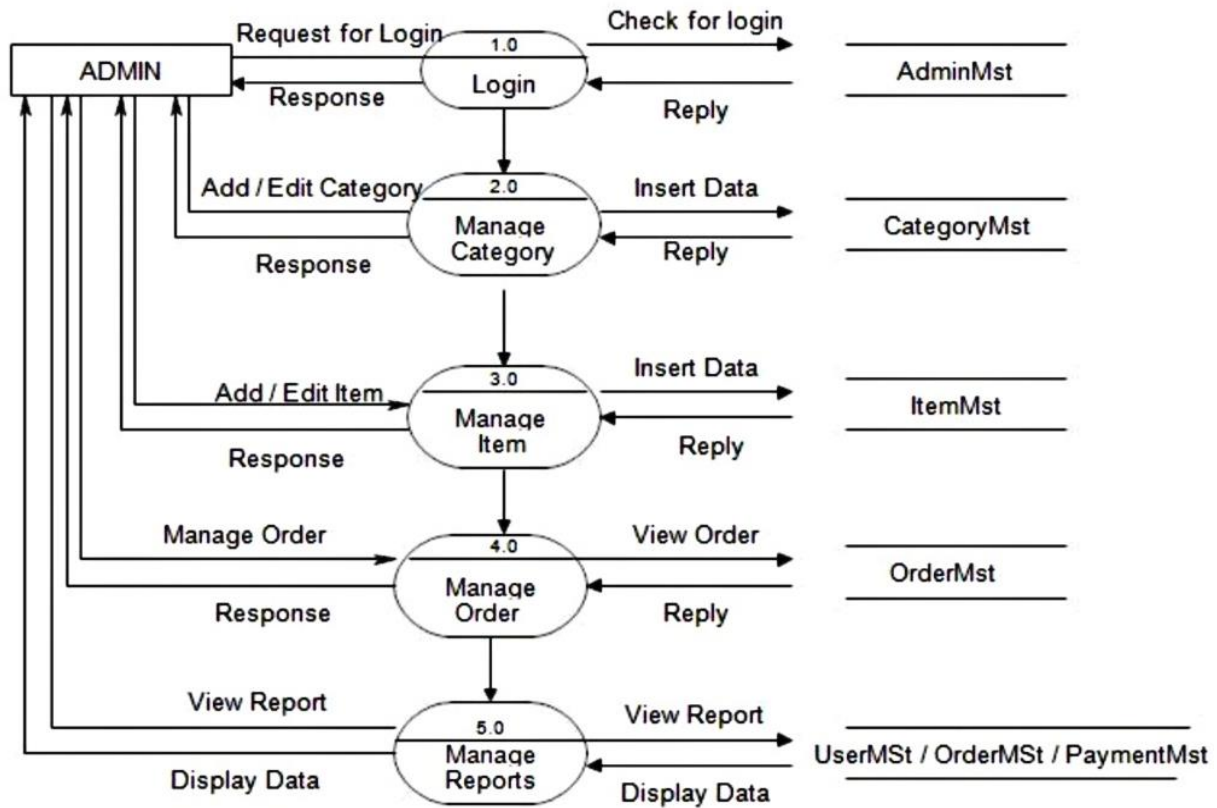


### 4.11. Data Flow diagram

Level 0:-



Level 1:-



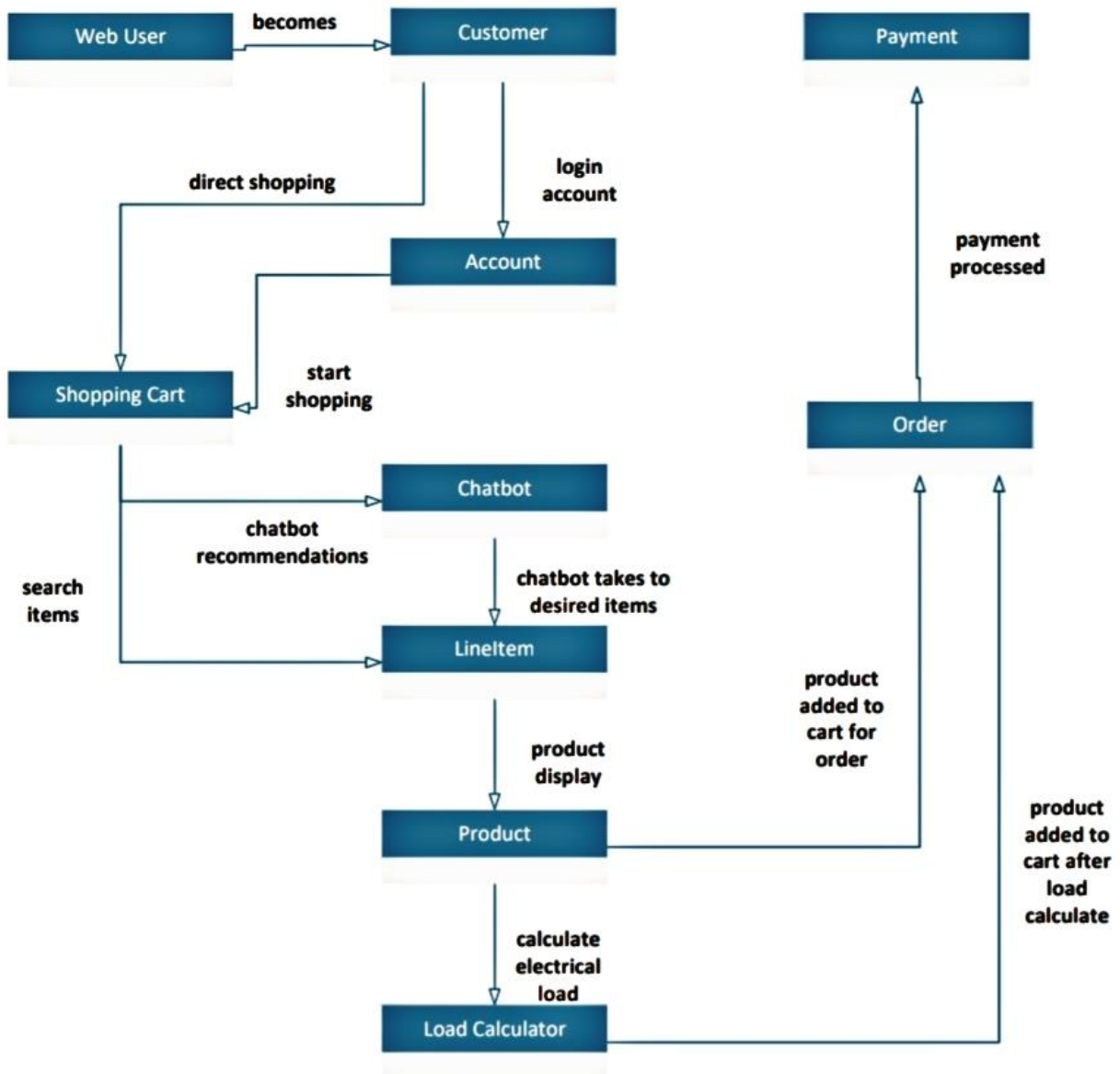
# Chapter 5

## Implementation

## Chapter 5: Implementation

Implementation is the realization of the application, that carries out execution or practice of a plan, or a method, or any specification, idea, model policy, or standard for doing some task. The implementation is the action that should follow the preliminary thinking for something to happen.

### 5.1. Important Flow Control/Pseudo codes



## 5.2. Components, Libraries, Web Services and stubs

Our web software system has bindings and public interfaces that are described using HTML. The system may then interact with the Web service in a manner prescribed by its definition, using HTML based messages conveyed by Internet protocols.

Libraries:

- React
- Node JS
- MongoDB
- Bootstrap

Stubs:

```
1  import React from "react";
2  import { Switch, Route } from "react-router-dom";
3  import LandingPage from "../Pages/LandingPage/LandingPage";
4  import Generators from "../Pages/LandingPage/Generators";
5  import Solar from "../Pages/LandingPage/Solar";
6
7  function App() {
8    return (
9      <>
10     <Switch>
11       <Route path="/" exact component={LandingPage}></Route>
12       <Route path="/generators" component={Generators}></Route>
13       <Route path="/solar" component={Solar}></Route>
14     </Switch>
15   </>
16 );
17 }
18
19 export default App;
20
```

### **5.3. Deployment Environment**

We will use localhost for development purposes and testing. We will use AWS services for deployment and production.

### **5.4. Tools and Techniques**

Tools:

- VS Code
- NodeJS
- Express JS
- Bootstrap
- ReactJS
- MongoDB
- Java Script
- HTML
- CSS

Technique:

- Agile Method

### **5.5. Best Practices / Coding Standards**

- Our code is properly commented and intended
- We are using an architectural pattern such as MVC
- Use of proper casing standards such as Camel case etc.
- Reusability in code

## 5.6. Version Control

We're going to use GIT version control where we can easily handle the speed and efficiency of our project. What's important is, we can easily manage and share code within our team members through the GIT.

# Chapter 6

## Testing and Evaluation

## Chapter 6: Testing and Evaluation

Evaluation is a process where components or system is compared against the specifications and requirements, through the testing phase. Furthermore, the results are evaluated in order to assess the progress of performance, design, supportability, maintainability, etc.

### 6.1. Use Case Testing

Table 6.1 Generators Screen (Customer)

<b>Test Case ID: 1</b>				<b>Test Design By: Saad Bin Aamir</b>		
<b>Test Module Name: Generators Screen (Customer)</b>				<b>Test Design Date: 20<sup>th</sup> Dec 2021</b>		
<b>Test Priority: High</b>				<b>Test Executed by: Raheel Asghar</b>		
<b>Test Title/Name: To test generators screen is showing all products</b>				<b>Test Executed Date: 20<sup>th</sup> Dec 2021</b>		
<b>Description: Test generators screen is showing all products</b>						
<b>Pre-condition: Open site and navigate to generators pages</b>						
<b>Dependencies:</b>						
<b>Step</b>	<b>Test Step</b>	<b>Test Data</b>	<b>Expected Result</b>	<b>Actual Result</b>	<b>Status (Pass/Fail)</b>	<b>Notes</b>
1.	Navigate to generators Pages		Generator's page is shown	Generator's page is shown	Pass	
2.	Wait for Backend to respond		Backend response is successful	Backend response is successful	Pass	
3.	Select Generator of choosing		Generator selection was successful	Generator selection was successful	Pass	
4.	Place Order					
<b>Post-condition: Generators pages work successfully</b>						

Table 6.2 Solar Screen (Customer)

<b>Test Case ID:</b> 2			<b>Test Design By:</b> Saad Bin Aamir			
<b>Test Module Name:</b> Solar Screen (Customer)			<b>Test Design Date:</b> 20 <sup>th</sup> Dec 2021			
<b>Test Priority:</b> High			<b>Test Executed by:</b> Adeel Tahir			
<b>Test Title/Name:</b> To test solar screen is showing all products			<b>Test Executed Date:</b> 20 <sup>th</sup> Dec 2021			
<b>Description:</b> Test solar screen is showing all products						
<b>Pre-condition:</b> Open site and navigate to solar pages						
<b>Dependencies:</b>						
Step	Test Step	Test Data	Expected Result	Actual Result	Status (Pass/Fail)	Notes
1.	Navigate to solar Pages		solar page is shown	Solar page is shown	Pass	
2.	Wait for Backend to respond		Backend response is successful	Backend response is successful	Pass	
3.	Select solar of choosing		Generator selection was successful	Generator selection was successful	Pass	
4.	Place Order					
<b>Post-condition:</b> Solar pages work successfully						

## 6.2. Equivalence partitioning

It is a software testing technique that is also known as equivalence class partitioning (ECP). Basically, it enables us to divide input data of our website unit into different partitions of the equivalent data, from which the test cases could be derived. In general, the test cases are designed in a way that it covers every partition once at least.

### **6.3. Boundary value analysis**

It is a software testing technique that we used in our website testing phase. Basically, as the definition suggests, we designed tests including representatives of the boundary values in a particular range. Henceforth, this idea would come from the boundary. As we have a set of test vectors in order to test our system website, therefore a topology could be defined on that particular set.

### **6.4. Data flow testing**

This testing is a type of structural testing that is used to find test paths in the website we are developing, according to uses of variables or locations of definitions.

### **6.5. Unit testing**

It is basically a software development process where small testable parts known as units of website, are tested to get proper functioning and operation. In our website, we highly focused on unit testing phase, where we individually and independently scrutinized the whole process for this testing. This type of testing was executed side by side by us while we were developing the website.

### **6.6. Integration testing**

Also known as I&T, the integration testing is a phase in a website testing where different modules are combined and tested as a group. In this case, we tested different modules of our website including chatbot, recommendation system, and load calculator. Basically, the integration testing is executed in order to evaluate the compliance of component or system, that is specified with functional requirements.

## 6.7. Performance testing



## 6.8. Stress Testing

We have used Jest testing which is a framework for JavaScript testing. It is designed and developed by Christoph Nakazawa with focus on support and simplicity for large web applications. This framework works with projects using React, Babel, Node.js, Typescript, Vue and Angular.js.

### **Code Break:**

After testing the app multiple times with different parameters, we have found that there were no code brakes. All modules are working properly.

### **Responsiveness:**

We have also concluded that the app is totally responsive and under all given situations it is working properly there are no leakages found.

# Chapter 7

## Summary, Conclusion and Future Enhancements

## **Chapter 7: Summary, Conclusion & Future Enhancements**

### **7.1. Project Summary**

The website that we are developing provides a digital platform to an already existing physical business. The owners of this business desire to expand their business by going digital and reaching out to more and more people through the internet.

Basically, they sell, repair and install electrical products like solar panels, power generators. They also sell different chemicals, as well as treat industrial wastewater with chemical substances.

So we are developing a website for their business. The website would be like an e-commerce store, as well as have a load calculator and recommendation system, which tells customers the estimated total of products to be installed.

### **7.2. Achievements and Improvements**

So, far we have achieved great skills in handling market affairs, relations, and responsibilities while working with an already existing market business. We have come to know the dealings in the market and gathered much more experience. Similarly, we have also improved our coding skills during development. Our project was in React language, which we had already studied in our previous semester but we didn't have much grip on the language until we implemented it ourselves in the development of this project. So, yes this fyp project has had a huge impact on our achievements and improvements in our future prospect in development.

### 7.3. Critical Review

This market project is executed by the development of best-in-class e-commerce website for a business, that is actually providing services in 2 fields, where one is electrical and the other is chemical. In the electrical field, they are selling, repairing, and installing generators, solar panels. In the chemical field, they are selling different chemicals, as well as providing services in water treatment plants (treating industry's chemical mixed water, and freeing it up from chemical substances before disposing into rivers, to prevent ecosystem)

So, far this particular company is running a physical business and they want to expand their business by going digital. They want their services to be online, so that a large number of people use their services, all over Pakistan.

Therefore, as our fyp project, we are developing a website that would have a touch of e-commerce for the products, they are selling. We will also include an appointment form for the customers to get their repairing services and water treatment services.

We are also adding a load calculator and recommendation system, which tells the users the estimated cost for the products to be installed. E.g if a customer is looking to install solar panels in a house or any property, he is not sure what would be the estimated cost, and how much panels would be needed. This is where our load calculator and recommendation system would come into play. We will give him options of how many lights, fans, TV, AC, refrigerator, and many other electrical appliances needed to be run on the solar panel. The customer would choose according to his requirements and he would get the total amount in front of him, on which he could place an order by entering details. The data would be recorded in our MongoDB database, and we would contact that person after receiving the details to proceed with the order.

### 7.4. Lessons Learnt

While developing the website, we encountered a number of errors in the execution of the project. There was also a time we got frustrated while solving the errors. We used to consult seniors, take help from the internet and books but still, a reasonable and conclusive solution was not being discovered by us to solve the errors. But we didn't lose hope or lose determination. We kept sticking to the project, kept ourselves busy in finding solutions and finally we were able to succeed in our goals. This is a story of the whole fyp, where in the development phase we were stuck in unlimited errors. But as a famous quote for a software developer says "an individual is not a software developer if he/she cannot overcome the challenge of errors and its solutions". Well, this is the area we always thrive off.

So, the lesson we learned is, do not lose your focus on achieving goals and objectives of life. Yes, you will encounter various challenges but keep facing them and you will ultimately find a valuable solution.

## 7.5. Future Enhancements/Recommendations

Right now, we are developing the web application for this business and it is in the English language. For our future enhancements, we will also develop a user-friendly mobile application, since most of the users these days have smartphones so a better opportunity to reach them is through the mobile app. Moreover, the majority of the population in Pakistan cannot read English so the Urdu version of the website would help them to understand each and everything on the website. Since, we are targeting every individual residing in Pakistan, so our target market is everyone.

Additionally, with our unique and easy concept of solar installation through online medium. We also want to grow the concept of solar panels usage in Pakistan. After all, it is a sustainable way of getting energy and since Pakistan get a great amount of sunlight so the solar panel is a great way of generating power which can reduce a huge burden on the economy as well.

# Appendices

## **Appendix A: User Manual**

The user manual acts information guide for the user, how to search for products, how to place an order, and how to get an accurate electrical load through load calculator.

### **A.1. Different Segments**

The user manual is divided into multiple segments that can act as a crucial information provider for the new user on the website.

#### **A.1.1. Order Placement, Product Search, Electrical Load Find**

From placing orders to searching products and finding electrical load, everything is available on the on the user manual. The manual automatically helps the user to be aware of how to proceed on the website and what is available. Whether his/her needs are going to get fulfilled through a particular website.

##### **A.1.1.1. Chatbot, Recommendation System, Load Calculator**

The Chatbot acts as a guide on the website that navigates customer on his/her desired part of the website. E.g if a customer is new on website and he/she doesn't know where to proceed they can get help from Chatbot that would facilitate in guiding them to their desired part.

When you are done calculating the load based on your electrical usage through load calculator, the recommendation system would recommend you how many sheets and batteries or solar panels are needed.

## **Appendix B: Administrator Manual**

The administrator manual acts a guide for the admin/s who are going to operate and manage this website. With this guide, they will get to know how to proceed when order is placed, how to manage the inventory, and how to add more products.

### **B.1. How to operate website?**

This is a major query for many admins that are newly introduced with a new system with different working aspects. Typically, managing e-commerce website is same but since the business owner is new to digital medium, so this guide will help him to manage the website. He will get to know how to process orders from payment to delivery process. The manual would also help him to manage the inventory. For the services side, this guide will help admin to manage the contact forms filled by customers, who are looking for an appointment.

## Appendix C: Information / Promotional Material

This section explains about the promotional material used to market a startup's goal. It helps to increase brand awareness among people, by enabling customers to know about the services and products offered by a particular brand or business. Basically, it's like an advertisement to grab audience attraction. The promotional material includes Brochure, Standee, Banner.

### C.1. Brocher

This brochure acts as a promotional material among customers for our chemical services.



This brochure acts as a promotional material among customers for our electrical services.



## C.2. Standee

Our poster designed as a standee for exhibition during fyp 1.

**FYP 01**

**Chem Power Engineering And Services**

**Team Members**

- Adeel Tahir (BSCS-S18-023)
- Raheel Asghar (BSCS-S18-043)
- Saad Bin Amir (BSCS-S18-036)

**Project Supervisor : Mr. Noman Jazeb**

**PROBLEM**

World is rapidly shifting towards online modes of e-commerce evolution. However, we're still stucked in old traditional systems.

**SOLUTION**

Its a User-Friendly ecomerce website that comes with latest and advanced features like Recommendation System, Chatbot, 3D Modelling, and Load Calculator. This is not only a ecomerce website, It also suggest customer an estimated cost based on his/her electricis usage.

**FEATURES**

- ★ Recommendation System: Helps recommend customer the estimated budget on installation of solar panels according to his/her usage of electricis and electronics.
- ★ AI Chatbot: Helps navigating customer to his/her desired part or module on the website, by acting as a guide or assistant.
- ★ 3D Modelling: Helps customers to view products at 3D angle, giving more clear view of the product.
- ★ Load Calculator: Helps calculating lead based on the total electricity use of the customer.

**TOOL & TECHNOLOGIES**

JavaScript, CSS, HTML, MongoDB, Unity, AI

**PROJECT SCREENSHOTS**

**Diagrams**

Activity Diagram, Architecture Diagram

**DEPARTMENT OF COMPUTER SCIENCE**

Our poster designed as a standee for exhibition during fyp 2.

**FYP 02**  
**SUPERIOR UNIVERSITY**  
**Chem Power Engineering And Services**

**Team Members**  
 Saad Bin Amir (BSCS-S18-035)  
 Raheel Asghar (BSCS-S18-043)  
 Adeel Tahir (BSCS-S18-023)

Supervised by : Mr. Noman Jazeb

**PROBLEM**  
 World is rapidly shifting towards the fastly paced online modes of e-commerce evolution. However, we are still stucked in traditional, old standards ways of selling goods and services.

**SOLUTION**  
 It is a user friendly e-commerce website that comes with latest and advanced features like Chatbot, Load Calculator, Recommendation System. Besides, being an e-commerce website, it also suggests the user about the estimated cost he is going to get based on his electrical usage.

**FEATURES**

- ★ **Recommendation System**  
 Helps recommend customer the estimated budget on installation of solar panels according to his/her usage of electric and electronics.
- ★ **AI Chatbot**  
 Helps navigating customer to his/her desired part or module on the website, by acting as a guide or assistant.
- ★ **3D Modelling**  
 Helps customers to view products at 3D angle, giving more clear view of the product.
- ★ **Load Calculator**  
 Helps calculating load based on the total electricity use of the customer.

**TOOL & TECHNOLOGIES**

JS, HTML, CSS, Node, Express.js, MongoDB, V, Ai, unity

**PROJECT SCREENSHOTS**

**Importance of E-Commerce**

**DEPARTMENT OF COMPUTER SCIENCE**

# Reference and Bibliography

## Reference and Bibliography

[1] Saad Bin Aamir, Raheel Asghar, Adeel Tahir, "Chem Power Engineering & Services" FYP Project Documentation, Session 2018-2022, FYP-BCSM-S21-006, Lahore-Pakistan, 2021-2022.

[2] The references for this website. The idea, way of working, and necessary information were taken into consideration from these references.

### Competitors

<http://khanassociates.net/>

[https://gfg.com.pk/greaves\\_air/web\\_new/index.php](https://gfg.com.pk/greaves_air/web_new/index.php)

<https://solarshop.pk/>

<https://homage.pk/>

<https://watercareservices.org/>

### Load Calculator Research

<https://solarasia.com.pk/solar-energy-load-calculator/>

<https://www.maxpower.com.pk/load-calculator/>

<https://www.ferozepower.com/energy-load-calculator/>

<http://www.cti.com.pk/solar-energy-load-calculator-in-pakistan/>

### Chatbot Research and Help

<https://chatbot-react.herokuapp.com/>

<https://www.chatbot.com/>

<https://acquire.io/blog/chatbot-design/>

<https://onix-systems.com/blog/how-to-design-a-chatbot-creating-a-conversational-interface>

### Recommendation System Research, Guide and Help

<https://www.analyticsvidhya.com/blog/2018/06/comprehensive-guide-recommendation-engine-python/>

<https://analyticsindiamag.com/a-guide-to-building-hybrid-recommendation-systems-for-beginners/>

[https://youtu.be/v\\_mONWiFv0k](https://youtu.be/v_mONWiFv0k)

[https://github.com/grahamjenson/list\\_of\\_recommender\\_systems](https://github.com/grahamjenson/list_of_recommender_systems)

# Index

## **Index [Main Keywords]**

chat bot.....	iii, 4, 5, 6, 11, 12, 16, 17, 18, 22, 43, 51, 58
load calculator.....	iii, 2, 3, 4, 5, 11, 16, 17, 18, 22, 42, 43, 47, 49, 48, 51, 58
recommendation system .	iii, vii, 2, 3, 4, 5 , 9, 10, 11, 12, 15, 16, 17, 42, 43, 45, 46, 47, 49, 51, 58

