CSL 2060 - Project

Software Design and Architecture Document

for

Click to Order

An Online Food Ordering System

Team Members

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Software Architecture Model

- Software architecture deals with the design and implementation of the high-level structure of the software. It is the result of assembling a certain number of architectural elements in some well-chosen forms to satisfy the major functionality and performance requirements of the system, along with some other, non-functional requirements such as reliability, scalability, portability, and availability.
- Software architecture = {Elements, Forms, Rationale/Constraints}
- To describe a software architecture, we use a model composed of multiple views or perspective (i.e. 4+1 views):
    - Physical or Deployment View
    - Logical View
    - Process View
    - Development View
    - Use Case/User Scenario (Fifth View)
- Logical view
    - The logical view is the object model of the design i.e. when an object-oriented design method is used.
    - It is mainly concerned with the functionality that the system provides to end-users. UML diagrams including class and state diagrams are used to represent the logical views.
- Process view
    - The process view captures the concurrency and synchronization aspects of the design.
    - It deals with the dynamic aspects of the system, explains the system processes and how they communicate as well as focuses on the run time behavior of the system.
    - UML diagrams to represent process view include the sequence diagram, communication diagram and activity diagram.
- Development view
    - The development view describes the static organization of the software in its development environment.

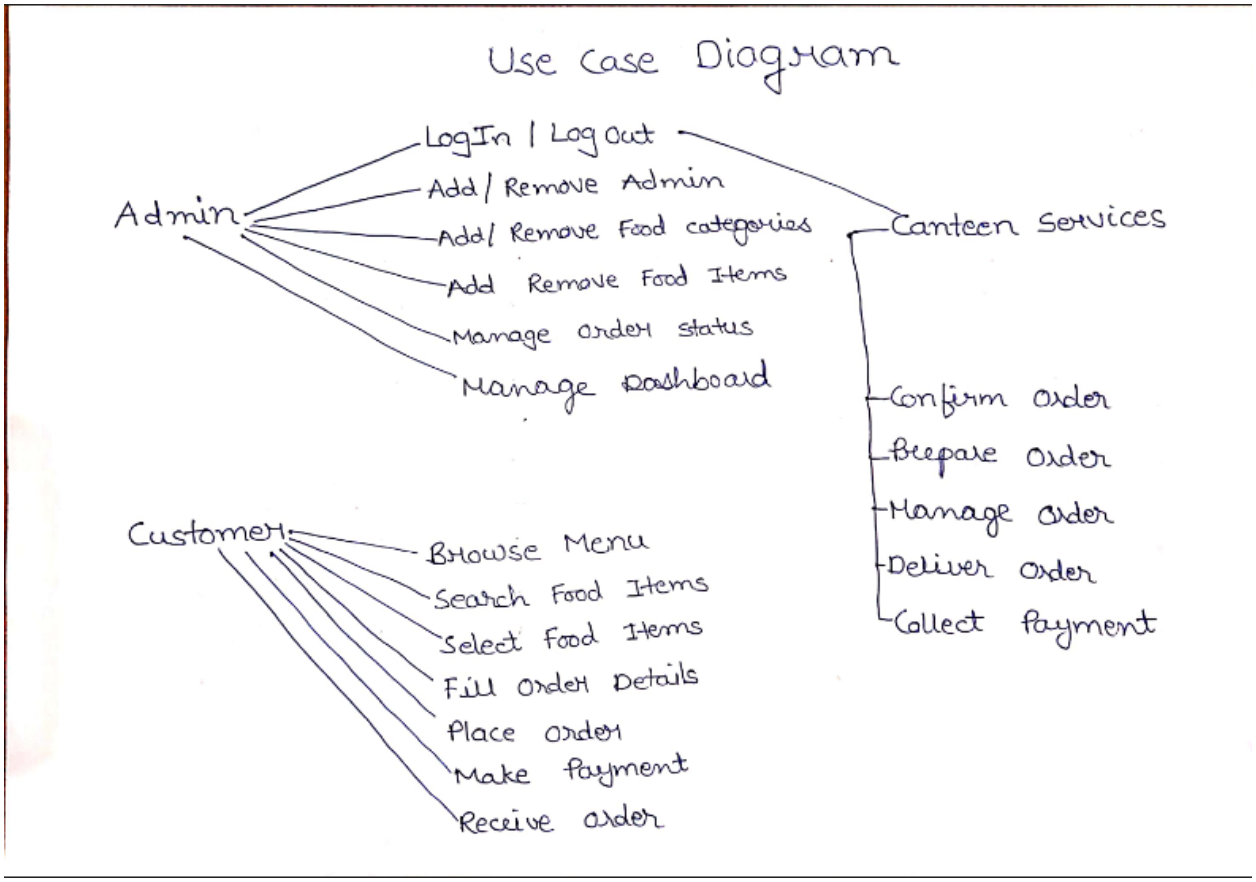
    - It illustrates a system from a programmer's perspective and is concerned with software management.
    - UML Component Diagram is used to describe system components.
- Physical view
    - The physical view describes the mappings of the software onto the hardware and reflects its distributed aspect.
    - It is concerned with the topology of software components on the physical layer as well as the physical connections between these components.
    - This view is also known as the deployment view. UML diagrams used to represent the physical view include the deployment diagram.
- Use Case/User Scenario
    - The description of an architecture like the decisions made can be organized around these four views, and further illustrated by a few selected use cases/ user scenarios which becomes the fifth view.
    - They describe the sequence of interactions between the objects and processes, and are used to identify architectural elements as well as validate design.
    - Moreover, use case views also serve as a starting point for tests of an architecture prototype.

1. Use Case/ User Scenario

- Software – Click To Order - An Online Food Ordering System
- Use Case – Food Ordering
- The system provides the user as well as the admin with the following feature:
    - For User
        - **Food Menu and Categories -** Customers can order food from the food menu or go through individual categories available to select their food item they wish to order.
        - **Select Food Item** - Customers can select the desired food items from the menu on the basis of their choice or various categories available. They are also provided with the facility to search the food items from the menu.
        - **Order Food** - Customers can order the food they wish to order. After placing the if the order is confirmed the "Congrats! Your Food Item is Ordered Successfully" message appears on the screen thereby confirming the order.
    - Admin Panel
        - **Log-in -** The admin can login into the admin panel using his/her unique Username and Password. In order to maintain privacy the password entered is encrypted using the md5 hashing algorithm.
        - **Manage Admin** - The manage admin functionality allows the admin to add / delete admins thereby allowing the managing of more than one admin. They can also update their username along with the password as well.
        - **Manage Dashboard** - Admin can keep track of the number of food categories and menu. They also have an option of keeping track of the number of orders made and the total revenue generated.
        - **Manage Food Items -** Admin can add new food categories and food items as per the availability of the raw materials provided to them by the supplier .Moreover, they can also delete the existing categories and food items along with updating their details such as price, description or image.
        - **Manage Order -** Admin can manage the order, change the status of the order as Ordered, On Delivery, Delivered and cancelled depending on the situation.

The stakeholders associated with the above specified use case are:

- Customers/ Users - They are the recipient of the food orders obtained from the Restaurants for a monetary consideration.
- IITJ Canteen Services - They are responsible for the daily operations of the canteen as well as its overall direction, profitability, and reputation. Moreover, they are responsible for delivering the food to the customers.
- Staff – Once the food is ordered and is confirmed by the restaurant, the chef starts preparing the dish.
- Software developer - They analyze user's needs and then design, test, and develop the software to meet those needs.
- IT Security - They are critical for various reasons like protecting the privacy and sensitive data of customers (such as using md5 hashing algorithm to encrypt the passwords).
- Customer Service/ Help Desk - They serve as a customer contact platform for all the queries related to the payment and thus help to improve the overall customer experience. They help in resolving the issues related to order, payment, quality of food through phone or social media accounts.
- Suppliers - They provide the Canteen with raw materials like vegetables, meat, groceries and at the same time ensure their quality, delivery schedules, and rationale price.

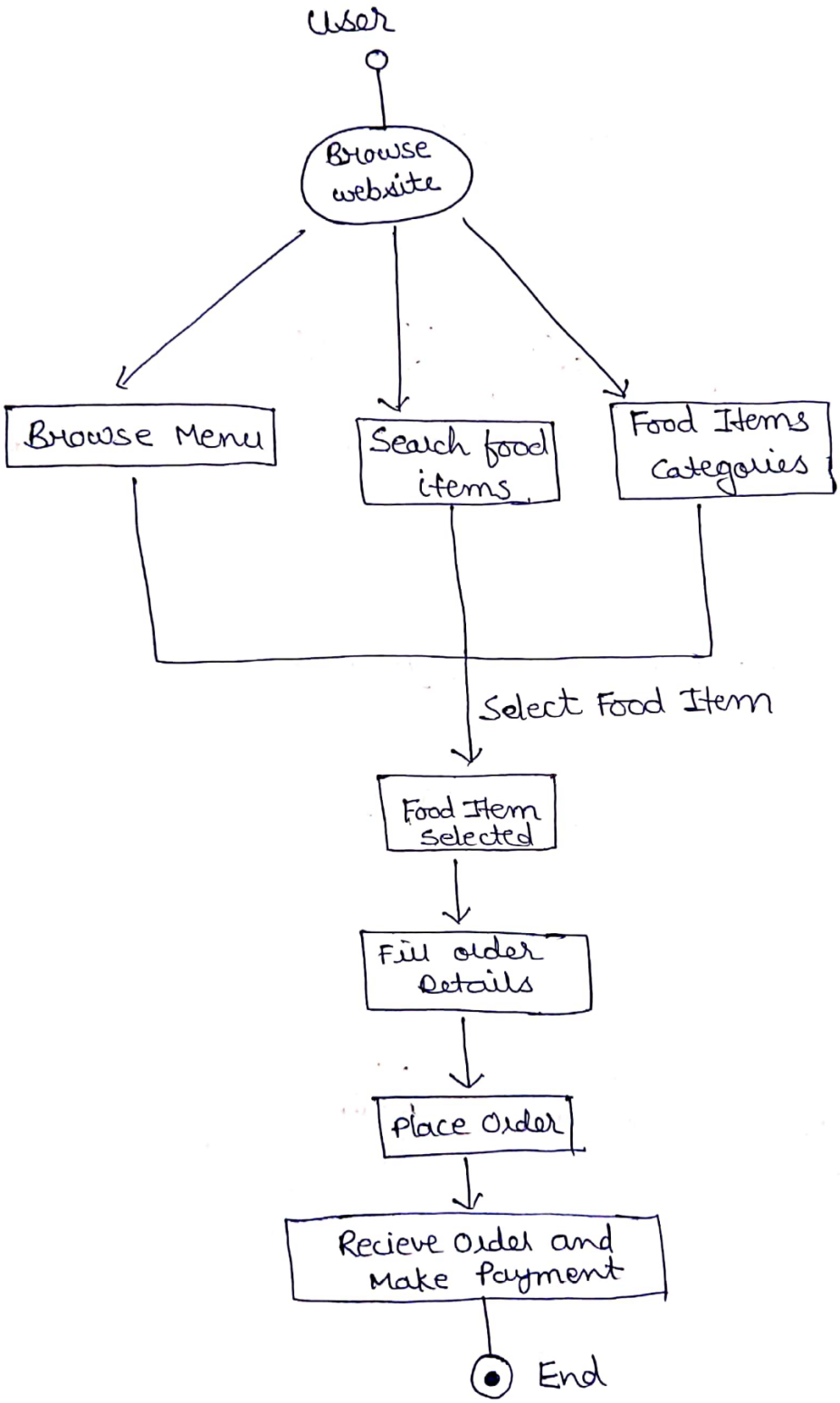


2. Logical Views

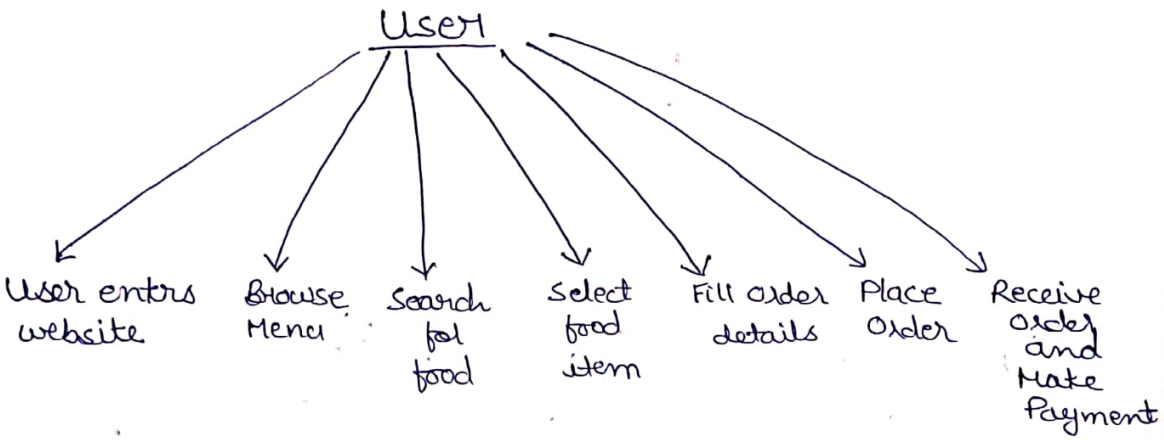
- The logical view primarily supports the functional requirements—what the system should provide in terms of services to its users.
- The system is decomposed into a set of key abstractions which are taken mostly in the form of objects or object classes. They exploit the principles of abstraction, encapsulation, and inheritance.
- The main component of the logical view is the design model. The design model gives a concrete description of the functional behavior of the system and is derived from the analysis model. Further, the analysis model gives an abstract description of the system behavior based on the use case model.
- The decomposition not only helps in functional analysis, but also serves to identify common mechanisms and design elements across the various parts of the system.

- Usually, a logical view is represented using the State Diagram where they are used in order to identify the key object characteristics.
- For User
    - Browse Menu and Search - Customers can search for the food of their choice from the menu or go through individual categories available. They are also provided with the facility to search the food items from the menu. Moreover, they are also provided with an attractive and easy-to-use GUI(Graphical User Interface).
    - Order Food - Customers can order the food they wish to order after entering their details including the name, mobile number and address.
    - Receive Order and Payment - Once the order is placed a confirmation message is received and accordingly when the food is prepared it is delivered to the customers where they make the necessary payment for their order.
- For Admin
    - LogIn - The Login module allows the admin to enter using his/her unique Username and Password.
    - Manage Admin - The manage admin module allows the admin to manage more than one admin as well as also allow them to update their username along with the password as well.
    - Manage Catalog - The Manage Catalog module allows the admin to add new food categories and food items as per the availability of the raw materials provided to them by the supplier.
    - Manage Dashboard and Order Status - The Manage Dashboard and Order Status module allows the admin to manage the existing categories of the food items along with their details such as price, description or image according to their choice. Moreover, they can also keep track of the total number of orders along with revenue generated.

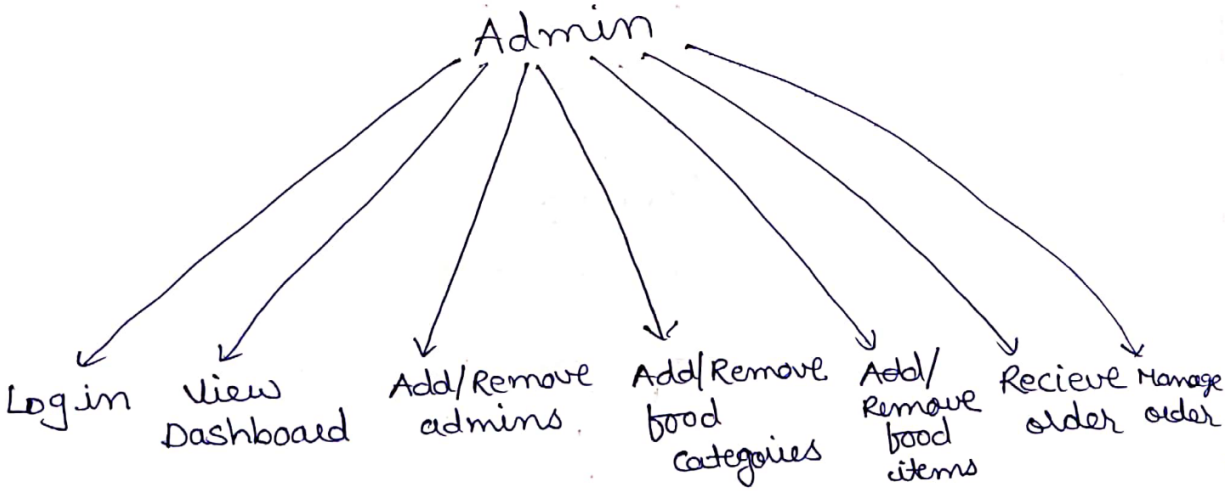
State Diagram



Logical View: User

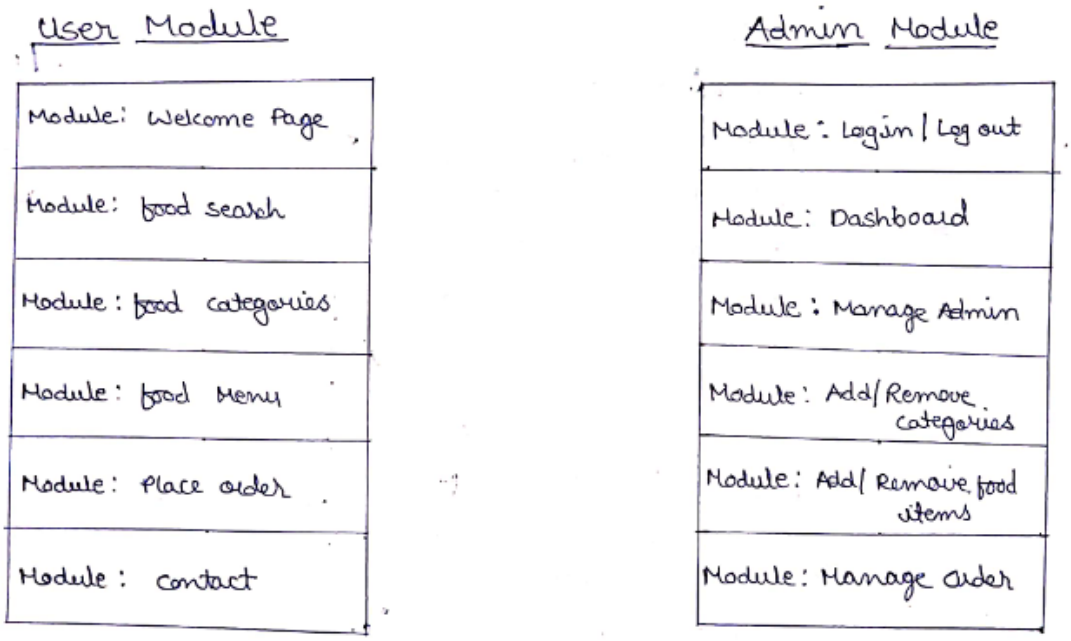


Logical View : Admin



3. Development View

- The development view shows how the system is structured, with an emphasis on the concerns of developers and testers. It communicates the aspects of the architecture of interest to those stakeholders involved in building, testing, maintaining, and enhancing the system.
- It describes the static organization or structure of the software in its development environment and focuses on the actual software module organization in the software development environment.
- The software is packaged in subsystems (which are organized in a hierarchy of layers) and are developed by one or a small number of developers. The subsystems are layers providing a narrow and well-defined interface to the layers above it.
- The development view takes into account the internal requirements related to the ease of development, software management, reuse, and to the constraints imposed by the toolset, or the programming language.
- It serves as the basis for requirement allocation, for allocation of work to teams (or even for team organization), for cost evaluation and planning, for monitoring the progress of the project, for reasoning about software reuse, portability and security.
- Component diagrams (used to represent development view) are used to model the physical aspects of a system such as executables, libraries, files, documents, etc. which reside in a node.
- They are used to visualize the organization and relationships among components in a system.

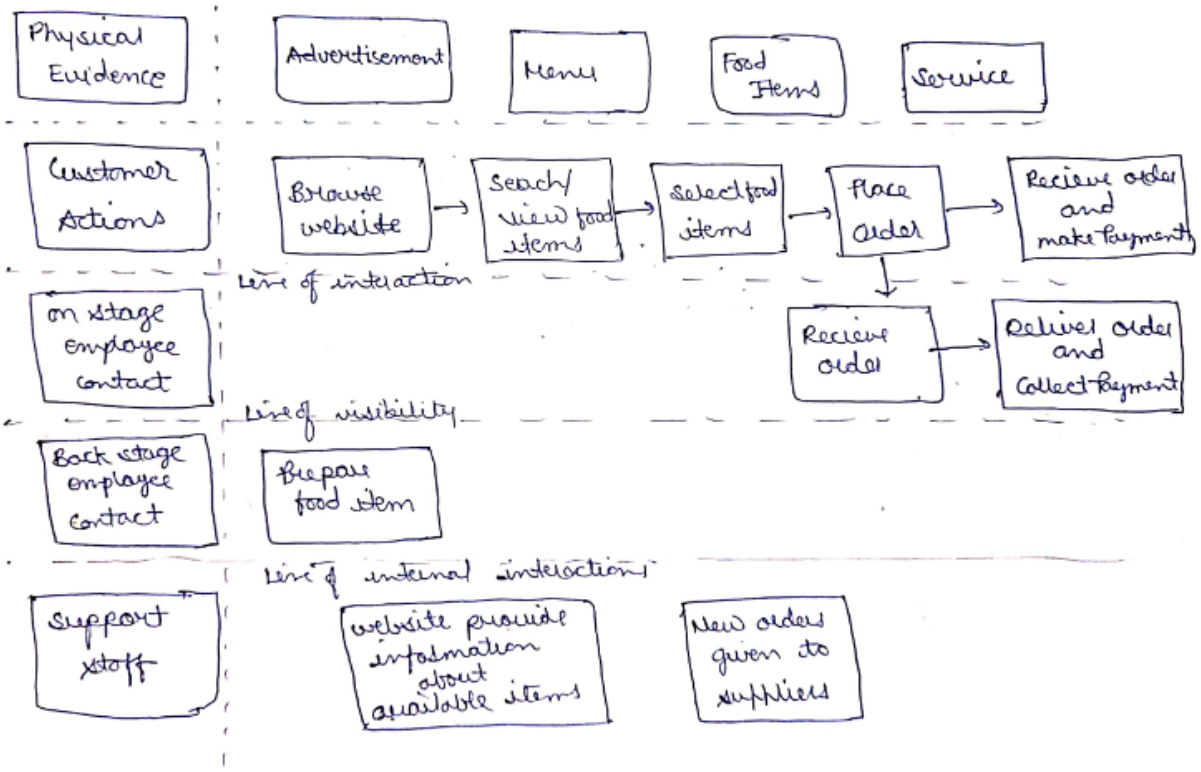


4. Process View

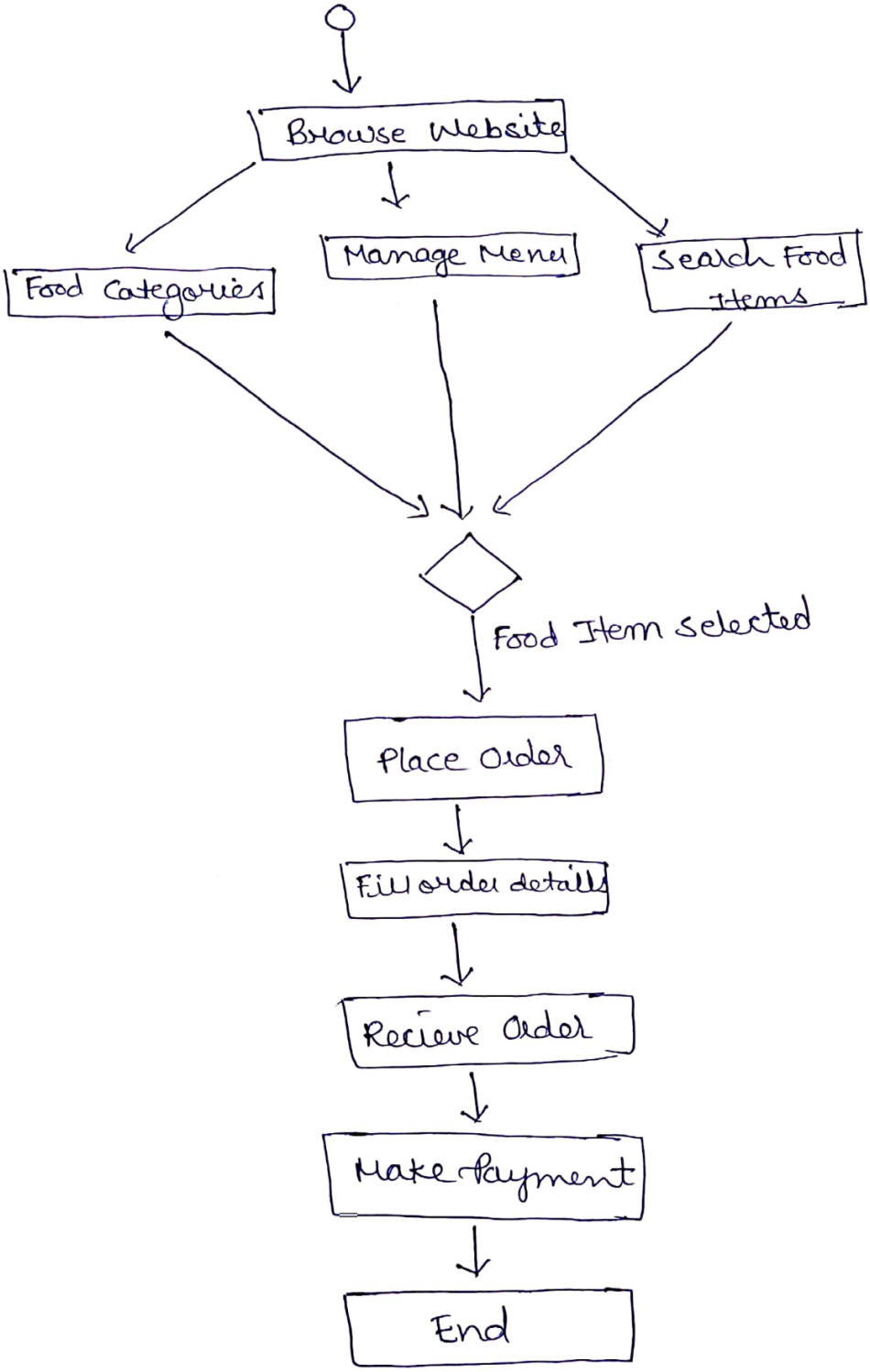
- The process view provides a basis for understanding the process organization of the system and takes into account various non-functional requirements, such as performance and availability.
- It includes the mapping of classes and subsystems on to processes and threads and is refined during each iteration.
- The static and dynamic aspects of this view are captured using various diagrams including sequence,communication and activity diagrams with a focus on active classes that represent threads and processes.
- Process View mainly addresses the issues of concurrency and distribution, of system's integrity, fault-tolerance, and how the main abstractions from the logical view fit within the process architecture on which thread of control is an operation for an object actually executed.

- The process view can be described at several levels of abstraction, with each level addressing different concerns. At the highest level, it can be viewed as a set of independently executing logical networks of communicating programs.
- Further processes represent the level at which the process architecture can be tactically controlled (i.e., started, recovered, reconfigured, and shut down) and be replicated for increased distribution of the processing load, or for improved availability.
- Sequence diagrams describe interactions among classes in terms of an exchange of messages over time. They're also called event diagrams. A sequence diagram is a good way to visualize and validate various runtime scenarios.
- These can help to predict how a system will behave and to discover responsibilities a class may need to have in the process of modeling a new system.
- Communication diagram models the interactions between objects or parts in terms of sequenced messages. It represents a combination of information taken from Class, Sequence, and Use case diagrams describing both the static structure and dynamic behavior of a system.
- Moreover, it also shows which element each one interacts with better. On the other hand, Activity diagram is basically a flowchart to represent the flow from one activity to another activity.
- It is an important aspect of the dynamic aspect of the system.• The activities can be described as an operation of the system. The control flow is drawn from one operation to another.
- This flow can be sequential, branched, or concurrent. Activity diagrams deal with such flow control using different elements such as fork, join, etc.

Process View

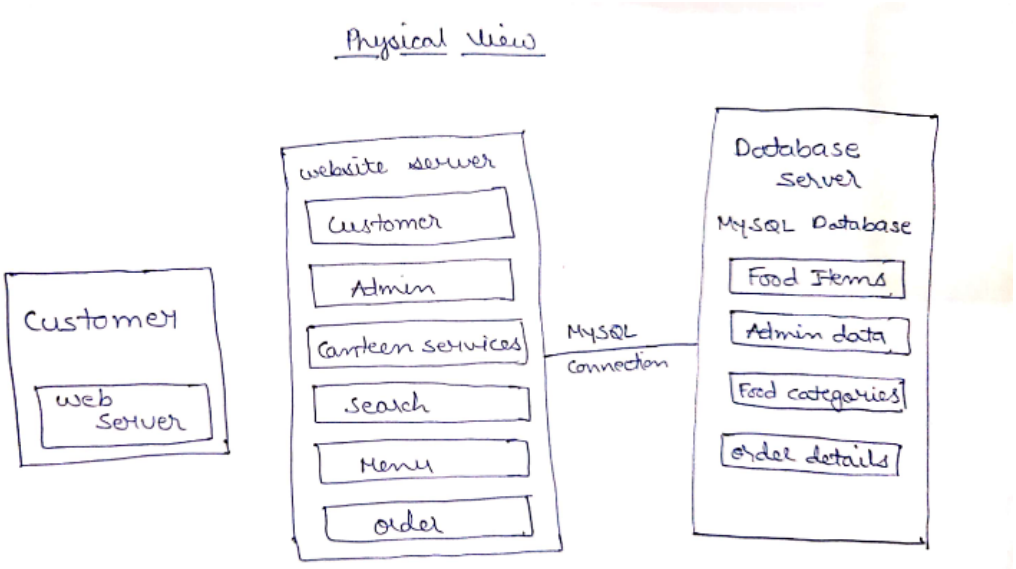


Activity Diagram



5. Physical View

- Physical view refers to the way data are physically stored and processed in a database by hardware mapping of application components or processes.
- It takes into account primarily the non-functional requirements of the system such as availability, reliability (fault-tolerance), performance (throughput), and scalability.
- The software executes on a network of computers, or processing nodes. The various elements identified—networks, processes, tasks, and objects—need to be mapped onto the various nodes.
- Due to various different physical configurations being used either for development and testing or deployment of the system for various sites, the mapping of the software to the nodes therefore needs to be highly flexible and have a minimal impact on the source code
- The physical view is often represented using deployment diagrams.
- Deployment diagrams are used to visualize the topology of the physical components of a system, where the software components are deployed.
- They are also used to describe the static deployment view of a system. Deployment diagrams consist of nodes and their relationships.



Relationship among 4+1 Views

- The elements in the four views work together seamlessly around user scenarios or use cases.The scenarios are an abstraction of the most important requirements where the design is expressed using object scenario diagrams and object interaction diagrams.
- The elements of one view are connected to elements in other views, following certain design rules and heuristics.
- For instance, concurrency is not addressed in the logical view, to achieve the process view, we need to map classes and their objects onto tasks and processes addressing concurrency and synchronization.
- Similarly, the processes and process groups are mapped onto the processing nodes of a physical computer network to obtain the physical view.
- Moreover, the use case view has a special significance. It details all the high level requirements of the system while all the other views detail how those are realized.
- The main benefits of 4+1 Views are:
    - It makes modeling easier.
    - It helps in better organization with better separation of concern.
    - It provides a way for architects to be able to prioritize modeling concerns.
    - It also makes it possible for stakeholders to get the parts of the model that are relevant to them.

	Logical	Process	Development	Physical	Scenario
Description	Shows the component (Object) of system as well as their interaction	Shows the processes / Workflow rules of system and how those processes communicate, focuses on dynamic view of system	Gives building block views of system and describe static organization of the system modules	Shows the installation, configuration and deployment of software application	Shows the design is complete by performing validation and illustration
Viewer / Stake holder	End-User, Analysts and Designer	Integrators & developers	Programmer and software project managers	System engineer, operators, system administrators and system installers	All the views of their views and evaluators
Consider	Functional requirements	Non Functional Requirements	Software Module organization (Software management reuse, constraint of tools)	Nonfunctional requirement regarding to underlying hardware	System Consistency and validity
UML – Diagram	Class, State, Object, sequence, Communication Diagram	Activity Diagram	Component, Package diagram	Deployment diagram	Use case diagram

Quality Attribute - **Maintainability**

- Maintainability refers to the characteristic that represents the degree of effectiveness and efficiency with which a product or system can be modified to improve it, correct it or adapt it to changes in environment, and in requirements.
- It refers to the ease with which we can repair, improve and understand the software code and is often undertaken by the developers by continuously adapting to the changes in order to meet the customer requirements and problems faced by them.
- Maintainability usually involves fixing bugs, optimizing the existing code and functionality along with adjusting the code to prevent any issues with the working

of the software. The longevity of the software often depends on the developer ability to maintain the code base of the software.

The various subcategories of the Maintainability attribute are :

- Modularity
    - It refers to the degree to which a system or computer program is composed of discrete components such that a change to one component has minimal impact on other components.
    - It is ensured that the changes made in one file does not affect the changes in other files and subsequently these changes are reflected on all the places wherever that file is used.
    - Maintainability of the code is calculated using :
        - Lines of code (LOC) If the number of lines of code is more then it becomes difficult to maintain them as compared to those with fewer lines of code.
        - Cyclomatic Complexity - It is a quantitative term to measure the complexity of a software as is calculated as CC= E — N + 2P.
    - In our project the code base contains different php files for each of the different components / actions. These are broadly for both users and admin interfaces respectively:
        - User
            - food-search.php: Food search file contains a search field where users can search for their favourite foods.
            - categories.php: Food categories contain information about how the various food categories are displayed. Each food category contains an image and name of the respective category.
            - category-foods.php: Category foods contains how the food items are managed under respective categories. Once the user selects any of the food categories, the user is prompted to food items available under that category.
            - order.php: Order file contains details about how the food is ordered. Once the user selects the item to be ordered, the user is prompted to order the page. Here the user has to fill in Email, Full Name, Phone Number and Address to confirm their

order. Once the order is successfully placed an order confirmation message is displayed on the screen.

- Admin
  - The code contains different php files for different actions. The user part has different files for different actions such as search, food menu, food categories. The admin module has different php files for log in, log out, manage food items and categories, manage orders and manage admins.
  - login.php: log in file contains a login form that the admin has to fill inorder to log in to the system. Admin has to enter Username and Password to successfully log in to the admin panel.
  - manage-admin.php: manage admin file contains details about managing admins. Admin can change their username, full name password using this section.
  - add-admin.php: This file is used to add a new admin into the system. The details required to add new admin are Username, Full Name and Password.
  - delete-admin.php: This file is used to delete an existing admin.
  - add-category.php: This file is used to add new food categories into our system. Category image and Name are required to add a new category.
  - delete-category: Delete category file is used to delete existing categories of food.
  - add-food: This file is used to add new food items into our system. Food Name, Description, Price, Food category and Image are required to add new food items onto the system.
  - update-food: Update food file is used to update details of existing food items, Admin can update Price, Name, Description, Category, Image of the existing food items.
  - manage-order: Manage order describes how and order is being managed. Once the customer places an order, the admin gets an order added into its list. Admin can view all the details filled by customers while placing an order.

        - update-order: Update order file is used to update the current order. Admin can update the status of order as Ordered, On Delivery, Delivered and Cancelled.

    - The various methods used to achieve high maintainability of the code include:
        - The maintainability of the code can be achieved by reducing the size of individual modules.
        - By not allowing many separate elements in the code in order to increase the cohesion and at the same reduce the coupling i.e. dependency of the individual components on each other.

- Reusability
    - It refers to the degree to which an asset can be used in more than one system, or in building other assets.
    - It is important as reusable codes help to save both time, energy and cost all of which are important in software development.
    - In order to make our code reusable we have considered upon certain key aspects including:
        - The code component apart from being modularized which also plays an important role in ensuring the reusability of code, has been written ensuring that components, boundaries, and interfaces which are relevant for code reuse.
        - The codes have been kept reusable by ensuring that the different components of the code fit together to create the software. Moreover, reducing the dependence of the components among themselves also helps to do the same.
        - Apart from this testing methods used have also helped to endure the reusability which also makes it easy to build large code bases from smaller components itself.
        - Therefore, besides maintaining the functionality and the performance reusability of the code has been maintained.
    - MoreoverIt is ensured that the software is designed in such a way so that it can run on all the web-browsers in various interfaces including mobile, desktop or tablet.

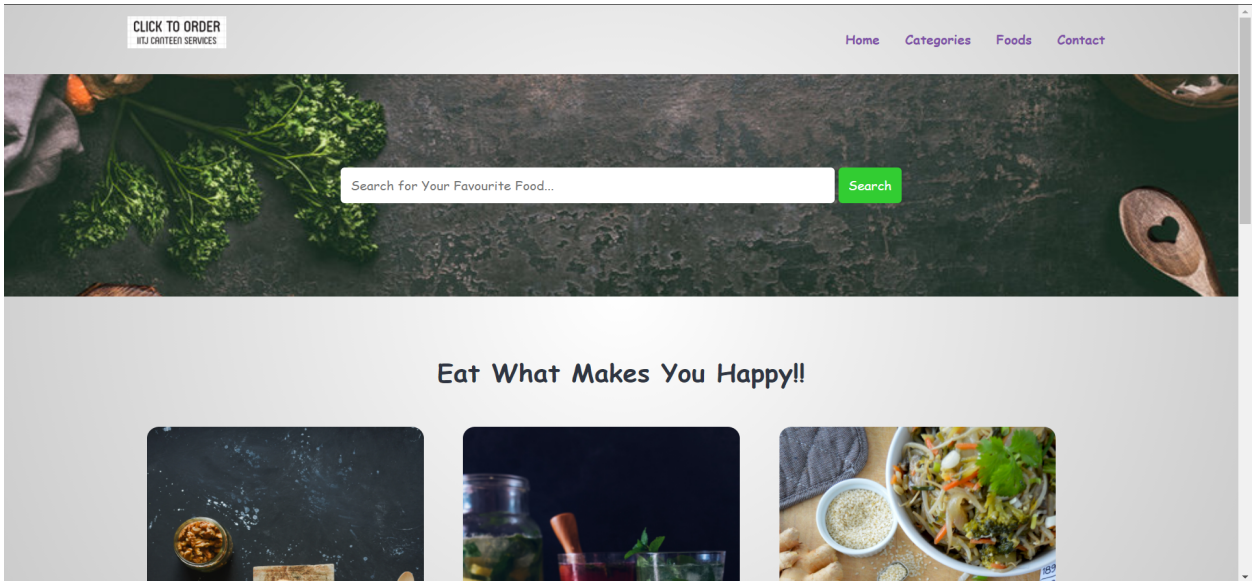
- Analysability
    - It refers to the degree of effectiveness and efficiency with which it is possible to assess the impact on a product or system of an intended change to one or more of its parts, or to diagnose a product for deficiencies or causes of failures, or to identify parts to be modified.
    - It discusses the effort estimation and reason for breakdown. Usually in complex software designs the effort estimation of failure is complicated, which makes it harder to understand the possibility of defects.
    - Therefore in order to ensure that the analysability of the code remains intact the complexity of the code has been kept optimal both dividing the code base in individual components that have their own functionality. This also helps to check for any errors easily without going through the entire code
    - Moreover, it has also been ensured that proper comments have been made wherever necessary in order to make it easier for the developers who are going through the code base to understand and make changes in the future.
- Modifiability
    - It refers to the degree to which a product or system can be effectively and efficiently modified without introducing defects or degrading existing product quality.
    - It is important for the developers to determine the specific design elements needed for modifiability as it helps to reduce the costs and saves time overall.
    - Generally the cost of modifiability is calculated as once the change has been specified followed by the designing, implementation, testing and deployment of the new implementation. The measure of the associated cost of these actions gives an estimate regarding the same.
    - It relates to the cost of change and refers to the ease with which a software system can accommodate the changes.
    - In order to ensure the modifiability various aspects have been kept in mind while designing the code :
        - The modularity of the code along with ensuring the loose coupling or dependencies on the individual components helps to determine the modifiability of the code.At the same time it also ensures that upon changing portions of the code does not affect the larger code base.

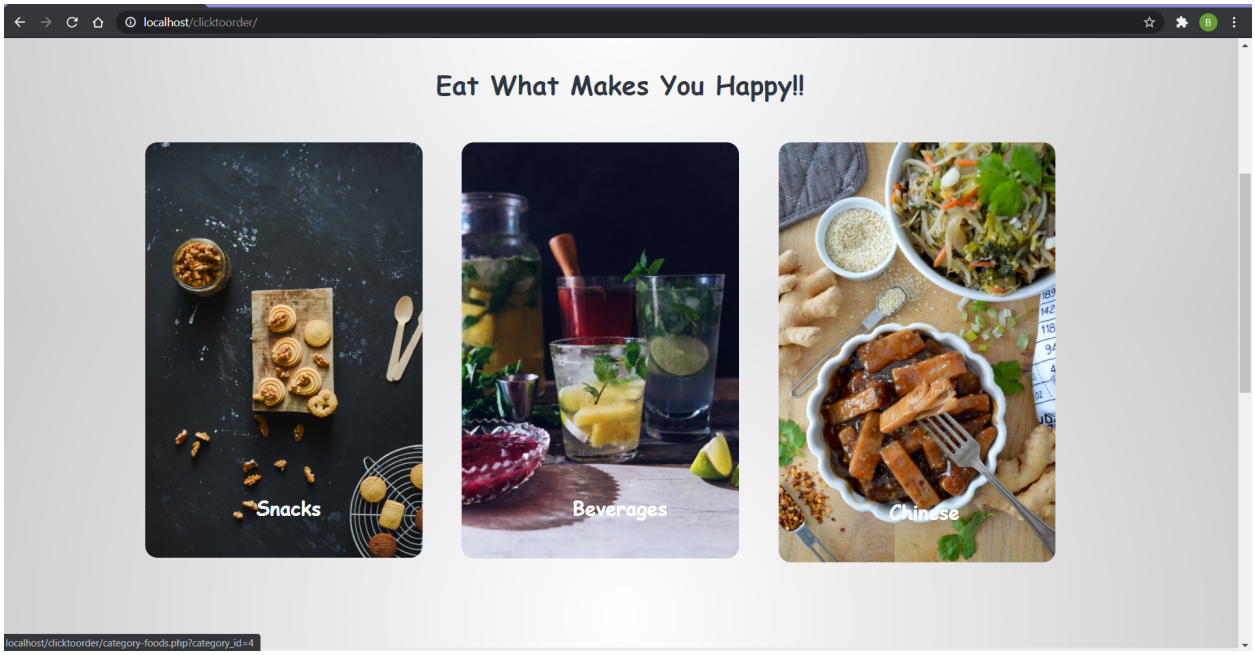
        - The involvement of developers to make system changes also play an important role in modifiability.
        - By maintaining optimal dependencies of the component semantic coherence has been maintained thereby affecting the modifiability.
    - Therefore in the software it has been ensured that the system can be compiled and modified easily along with updating it without any issue.

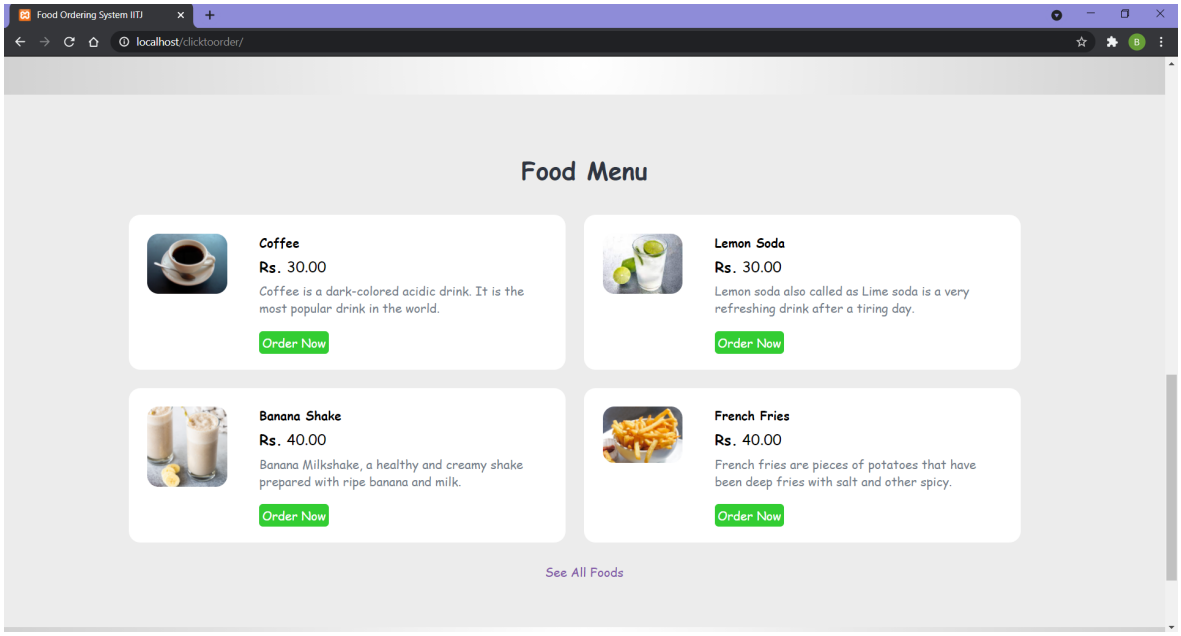
- Testability
    - It refers to the degree of effectiveness and efficiency with which test criteria can be established for a system, product or component and tests can be performed to determine whether those criteria have been met.
    - Testability is an important criteria as it helps to determine the efforts that are required to execute test activities on the software including the number of testing cases, their time duration and the test resources.
    - Greater testability of the software helps to ensure minimal efforts in finding the errors using testing.
    - In order to ensure the above mentioned parameters various key aspects have been considered while writing the code base:
        - By ensuring that all the elements in the UI are correctly and uniquely named.
        - The code for the software is unambiguous, consistent and complete in its functionality thereby allowing the system to be easily tested.
        - By making the backend code of the software similar in the functionality through similar software versions, database servers. Also the User Interface has been consistent in order to make the test modules easier to reuse.
        - Moreover, the system is tested for both the user interface and the database to ensure that the above mentioned parameter is ensured.

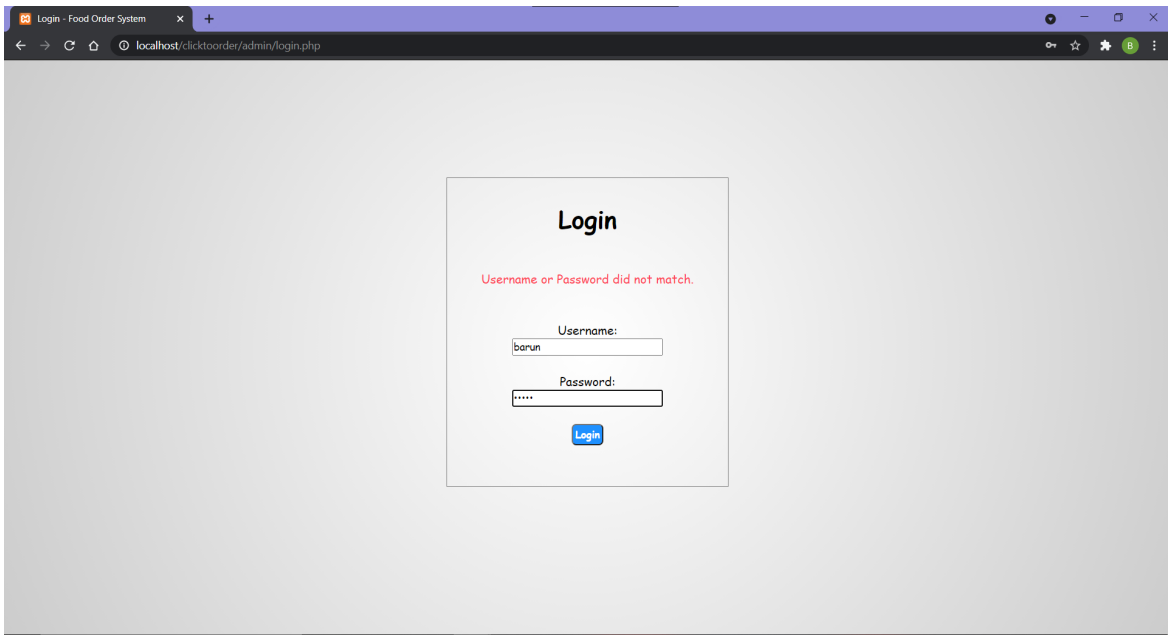
Software Design

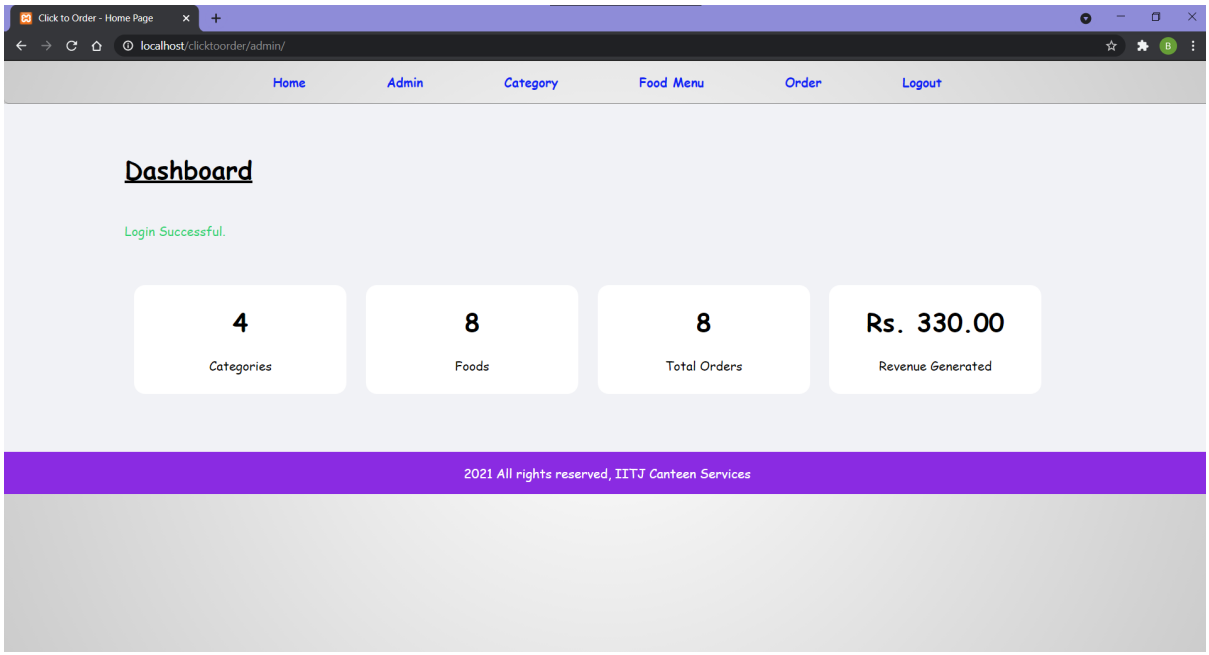
The software design of our project Click To Order

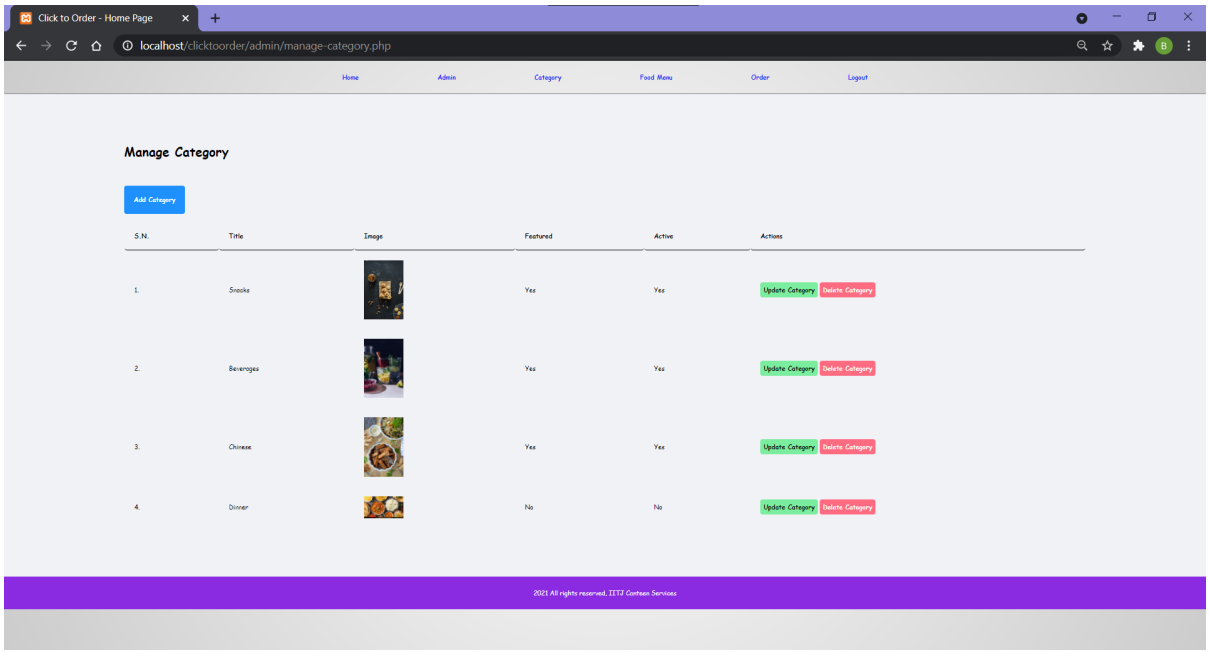
- 

- 


Food Ordering System IITJ
localhost/clicktoorder/
Food Menu
Coffee
Rs. 30.00
Coffee is a dark-colored acidic drink. It is the most popular drink in the world.
Order Now
Lemon Soda
Rs. 30.00
Lemon soda also called as Lime soda is a very refreshing drink after a tiring day.
Order Now
Banana Shake
Rs. 40.00
Banana Milkshake, a healthy and creamy shake prepared with ripe banana and milk.
Order Now
French Fries
Rs. 40.00
French fries are pieces of potatoes that have been deep fries with salt and other spicy.
Order Now
See All Foods


Login - Food Order System
localhost/clicktoorder/admin/login.php
Login
Username or Password did not match.
Username:
barun
Password:
Login


Click to Order - Home Page
localhost/clicktoorder/admin/
Home
Admin
Category
Food Menu
Order
Logout
Dashboard
Login Successful.
4
Categories
8
Foods
8
Total Orders
Rs. 330.00
Revenue Generated
2021 All rights reserved, IITJ Canteen Services


Click to Order - Home Page
localhost/clicktoorder/admin/manage-category.php
Home
Admin
Category
Food Menu
Order
Logout
Manage Category
Add Category
S.N.
Title
Image
Featured
Active
Actions
1.
Snacks
Yes
Yes
Update Category
Delete Category
2.
Beverages
Yes
Yes
Update Category
Delete Category
3.
Chinese
Yes
Yes
Update Category
Delete Category
4.
Dinner
No
No
Update Category
Delete Category
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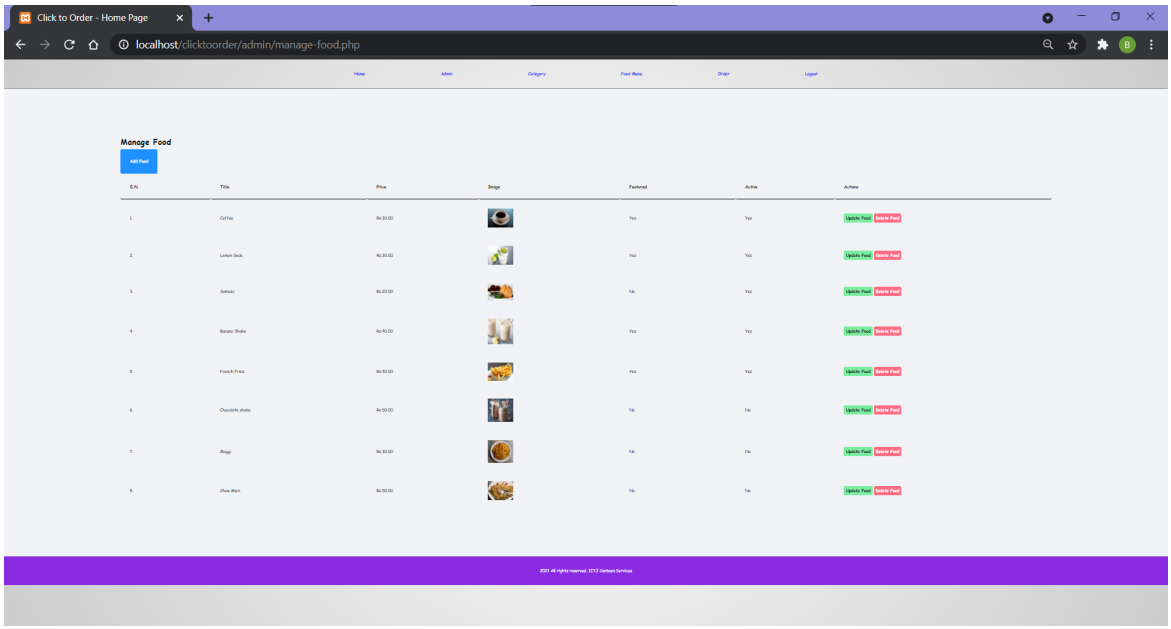
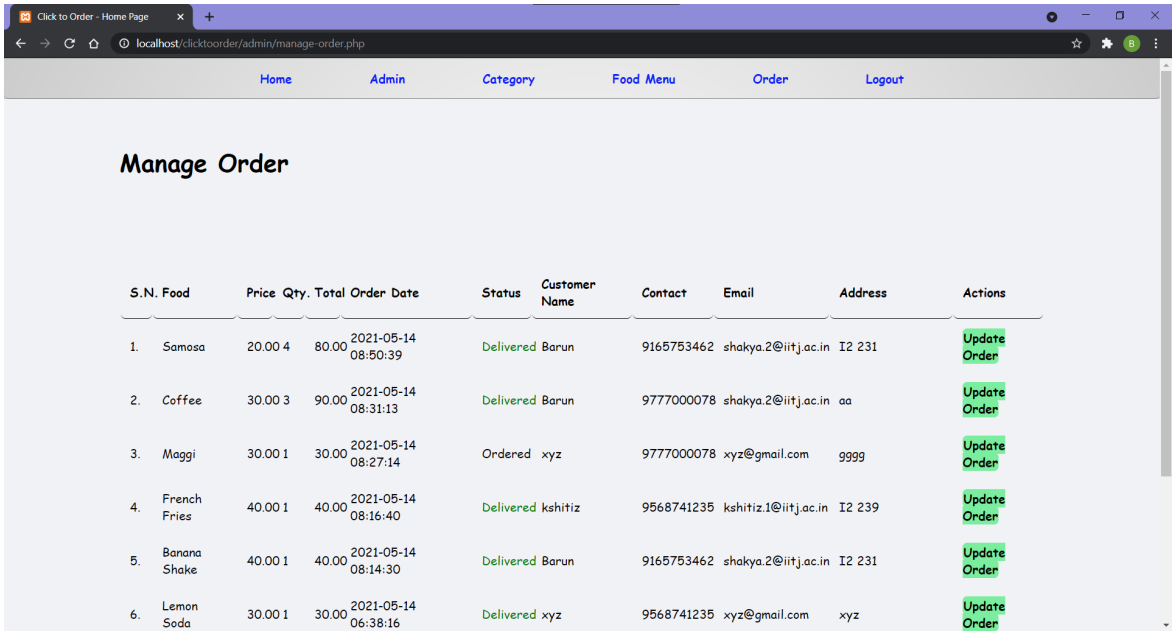
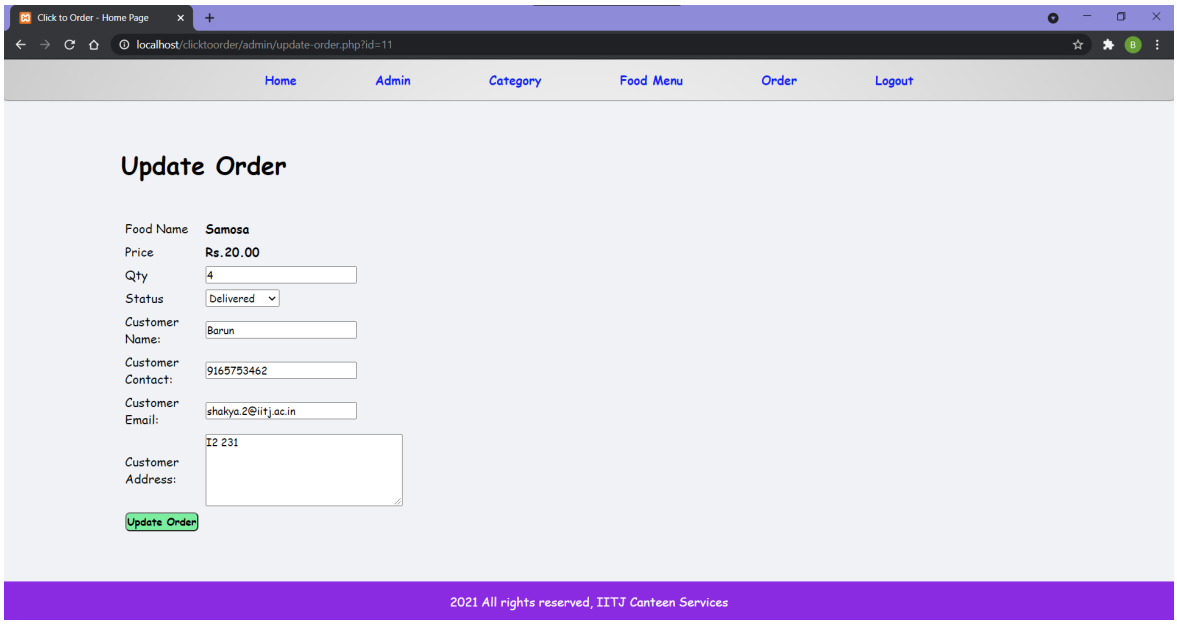
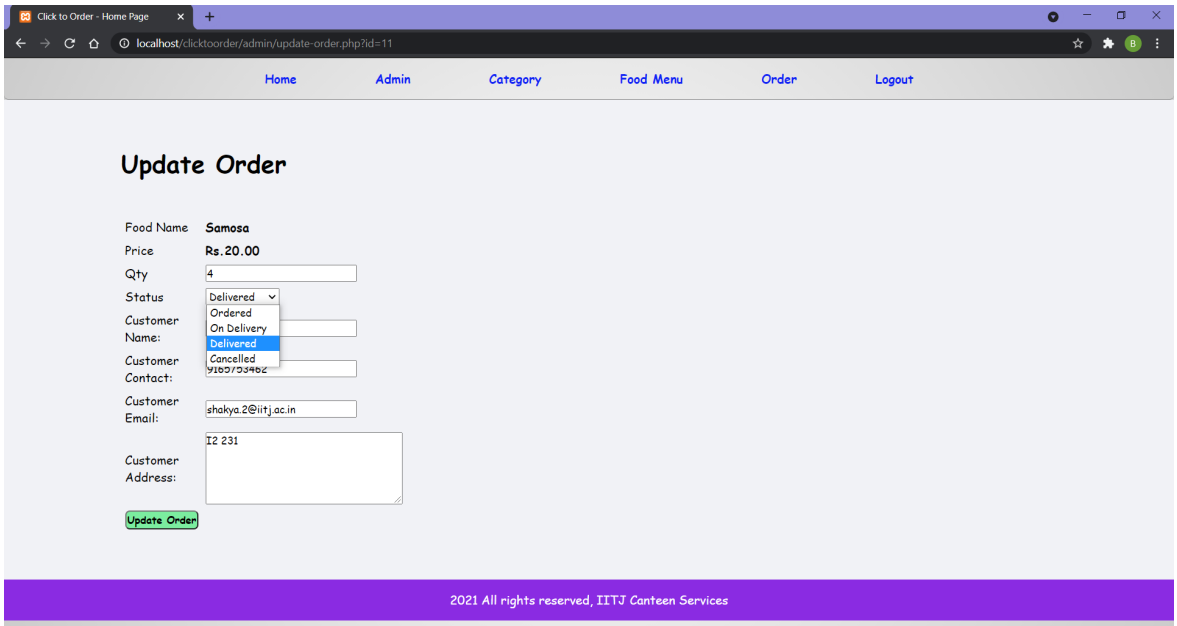
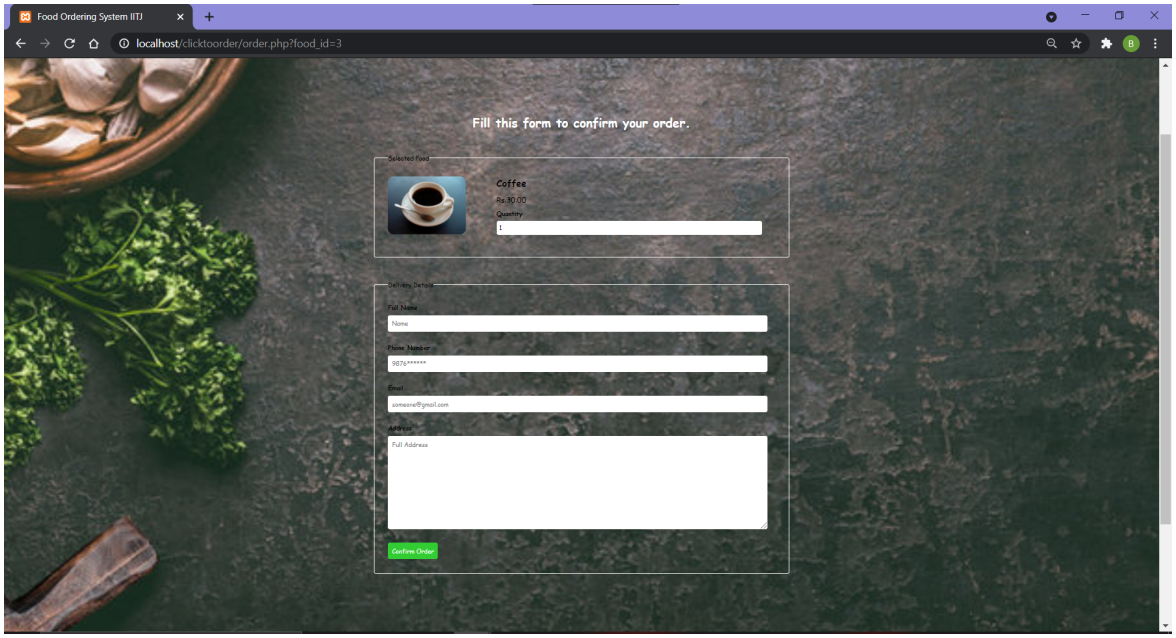


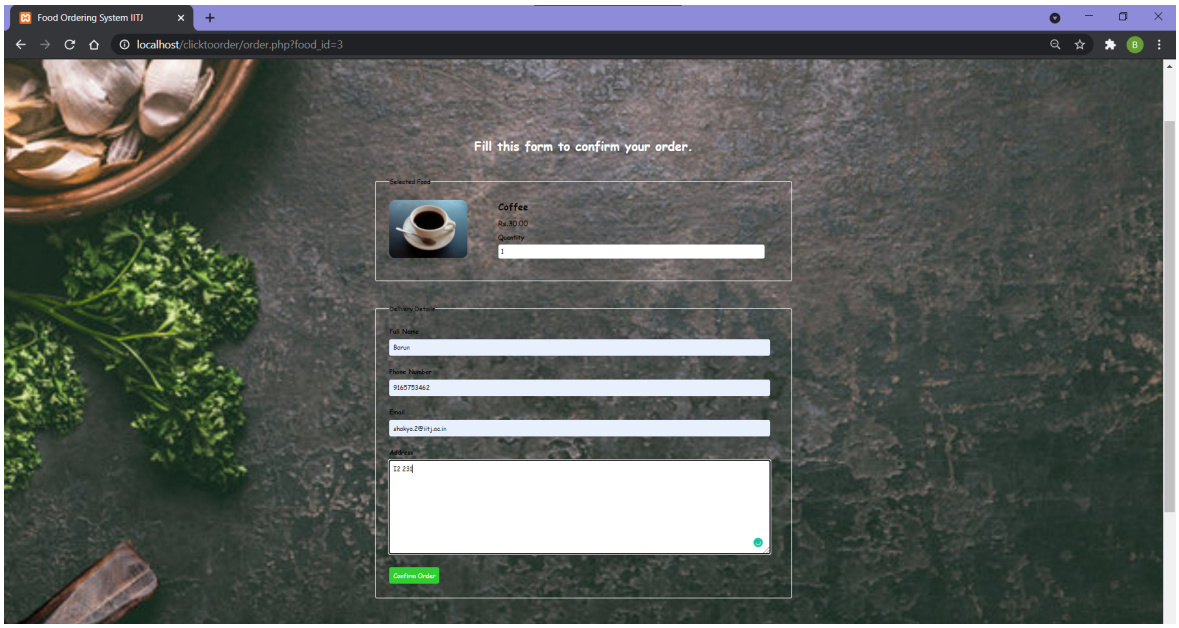


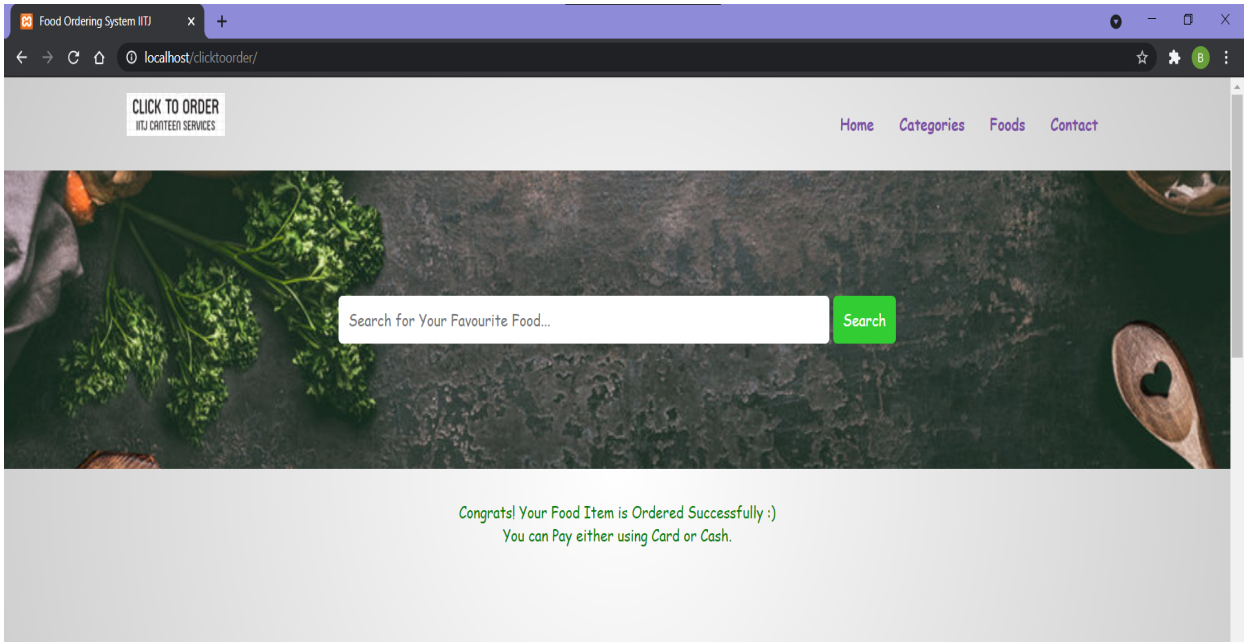
S.N.	Food	Price	Qty.	Total	Order Date	Status	Customer Name	Contact	Email	Address	Actions
1.	Samosa	20.00	4	80.00	2021-05-14 08:50:39	Delivered	Barun	9165753462	shakya.2@iitj.ac.in	I2 231	Update Order
2.	Coffee	30.00	3	90.00	2021-05-14 08:31:13	Delivered	Barun	9777000078	shakya.2@iitj.ac.in	aa	Update Order
3.	Maggi	30.00	1	30.00	2021-05-14 08:27:14	Ordered	xyz	9777000078	xyz@gmail.com	gggg	Update Order
4.	French Fries	40.00	1	40.00	2021-05-14 08:16:40	Delivered	kshitiz	9568741235	kshitiz.1@iitj.ac.in	I2 239	Update Order
5.	Banana Shake	40.00	1	40.00	2021-05-14 08:14:30	Delivered	Barun	9165753462	shakya.2@iitj.ac.in	I2 231	Update Order
6.	Lemon Soda	30.00	1	30.00	2021-05-14 06:38:16	Delivered	xyz	9568741235	xyz@gmail.com	xyz	Update Order


Click to Order - Home Page
localhost/clicktoorder/admin/update-order.php?id=11
Home
Admin
Category
Food Menu
Order
Logout
Update Order
Food Name
Samosa
Price
Rs.20.00
Qty
4
Status
Delivered
Customer Name:
Barun
Customer Contact:
9165753462
Customer Email:
shakya.2@iitj.ac.in
Customer Address:
I2 231
Update Order
2021 All rights reserved, IITJ Canteen Services


Click to Order - Home Page
localhost/clicktoorder/admin/update-order.php?id=11
Home
Admin
Category
Food Menu
Order
Logout
Update Order
Food Name
Samosa
Price
Rs.20.00
Qty
4
Status
Delivered
Ordered
On Delivery
Delivered
Cancelled
Customer Name:
Customer Contact:
Customer Email:
shakya.2@iitj.ac.in
Customer Address:
I2 231
Update Order
2021 All rights reserved, IITJ Canteen Services


Food Ordering System IITJ
localhost/clicktoorder/order.php?food_id=3
Fill this form to confirm your order.
Selected Food
Coffee
Rs.30.00
Quantity
1
Delivery Details
Full Name
Name
Phone Number
9876******
Email
someone@gmail.com
Address
Full Address
Confirm Order


Food Ordering System IITJ
localhost/clicktoorder/order.php?food_id=3
Fill this form to confirm your order.
Selected Food
Coffee
Rs.30.00
Quantity
1
Delivery Details
Full Name
Barun
Phone Number
9165753462
Email
Address
22 23
Confirm Order


Food Ordering System IITJ
localhost/clicktoorder/
CLICK TO ORDER
IITJ CANTEEN SERVICES
Home
Categories
Foods
Contact
Search for Your Favourite Food...
Search
Congrats! Your Food Item is Ordered Successfully :)
You can Pay either using Card or Cash.