Restaurant Management System (FineDine)

A dissertation submitted for the Degree of Master of Information Technology

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ABSTRACT

MIT 3101- Individual Project

(FineDine)

Nowadays technology touches every facet of our lives as it always has but with the emergence of mobile devices and cloud computing making more of an impact than ever, you'd be hard pressed to go anywhere and not find a high-tech piece of hardware or software around. These advances have made an impact everywhere, and one of the places we're seeing more and more technology is in the food and restaurant industry.

Basically most of restaurants current approach focusing on the manual labor and most of the operations are doing by human initiative. This makes the whole business process inefficient and time consuming because the current system consumes more time to carry out its operations the loss of time will be directly influencing the productivity of the restaurant.

FineDine is a tablet-based restaurant management system for the food, beverage, and hospitality industry, designed to save time and increase restaurant's revenue by making the process of restaurant management easier. It also helps to create repeat business building a stronger relationship with your customers and restaurant staff.

When comes to system features Stock/Inventory management module is the one feature that offers real-time tracking of inventory which reduces or eliminates waste, theft or inconsistency in stock levels. Based on the rise in the prices of any of the ingredients the menu prices also gets updated which makes the process of menu updating based on the price changes in the market a hassle free process. In other hand system enables two way communication between kitchen staff and customer through real time communication. When customer making order he or she can give some instructions regarding how they want, as an example when they required less salt, they can inform that to kitchen staff. And also kitchen staff can inform to customer how long they take to prepare the food.

Acknowledgement

I would like to thank all those who helped me in this project. I would also like to pay my sincere gratitude to all the lecturers who have helped me to accomplish this task. I also take this opportunity to pay my sincere gratitude to **Dr. Lakshman Jayarthne**. .Who gave me the required knowledge to accomplish the project. And finally I would like to pay my gratitude to all the staff members of UCSC and all the participants who gave there valuable contribution to make this task a success.

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List of Abbreviations

1. **BOM- Bill of material**

2. **POS – Point of sales**

3. **GUI – Graphical user interface**

4. **OTP – One time password**

1 Introduction

In the Modern world business it is hard to successfully cope with the market without adopting modern technology. Modern technology has become so vital that it has made the whole buying and selling system so easy that it can be done by the click of a button.

This document consists of an IT solution for fast food restaurants. Nowadays most of restaurants latest objective is to bring a futuristic appearance to its outlets and make its operation more efficient and provide even better customer service by introducing an automated solution. With that purpose here provides an automated solution mainly consisting with a mobile app and the documentation following its design, implementation, it's using and its basic functioning.

1.1 The Problem Statement

Basically most of restaurants current approach focused on the manual labor and most of the operations are done by human initiative. This makes the whole business process inefficient and time consuming because the current system consumes more time to carry out its operations the loss of time will be directly influencing the productivity of the restaurant.

Then the improve customer satisfaction, managing restaurant queues is gaining importance for increasing table turnover and revenues. Prior research establishes that although customers high importance on the speed of service. Because perceived wait time directly affects customer engagement, it is crucial to manage it in every customer interaction.

In other hand most of customers decide what they wants to buy after coming front of queue so that effecting to make long queue in restaurant.

Also the currently existing manual system does not have functionalities beyond the basic day to day operations of a restaurant and there has no proper way to capture regular customers and conduct promotions for them.

1.2 Scope of Project

Based on requirement analysis system divided into two main components

- ❖ **Supply chain management System**
  - ✓ **BOM Creation**
  - ✓ **Control inventory**
  - ✓ **Report & Analytics**
- ❖ **Order management system**

- ✓ **Make order**
- ✓ **Authentication**
- ✓ **Capture orders**
- ✓ **Payment**
- ✓ **Promotion handling**
- ✓ **Reports & Analytics**

➢ **Bill of material Creation**

When considering food industry bill of material is important process which also known as the BOM or recipe. The bill of materials is a listing of the raw materials and work in progress and the quantities of each needed to manufacture a finished product.
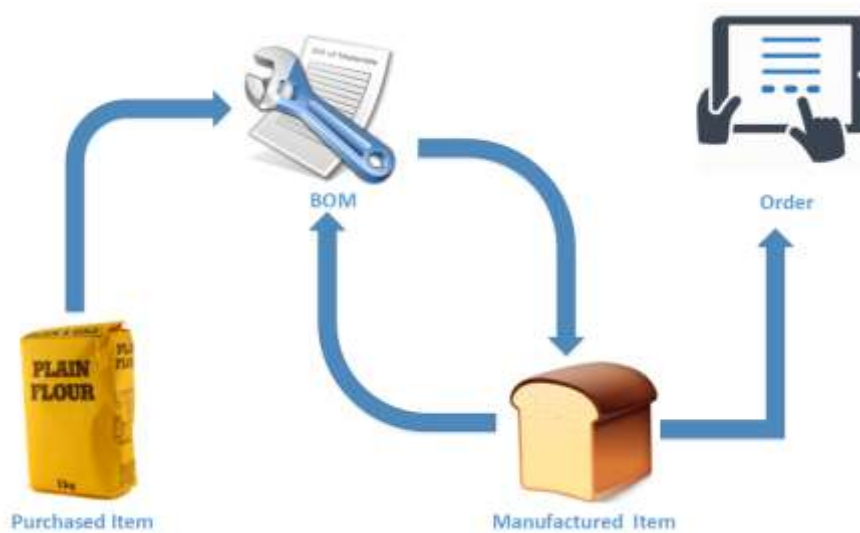
➢ **Control inventory**

Here most important approach is figure out and maintain the optimum level of items in the inventory. Then it will help to provide food items continuously on demand.

➢ **Reports & analytics**

Here main objective is collect information, organize it, and present it in a logical and concise form. That is helping to take decision about inventory. Basically system will include following reports.

- ✓ Material specification reports
- ✓ Stock balance report
- ✓ Costing report
- ✓ Supplier report

➢ Create orders

Creating an order is the main part of the system. When customer come to restaurant he or she can make order using tablet. The menu will displaying based on bill of material which created on supply chain management section. This will help to improve customer satisfaction proving quick response.

➢ Customer authentication

When customer came to restaurant before make order he or she need to enter phone number to the tablet , then system will generating OTP and simultaneously it will goes to customer mobile phone to as a SMS. Then customer need to enter that token to tablet before continue (authentication will be an optional and if restaurant management decide authentication no need, then gives an option to take only mobile number from customer).

Main purpose of this authentication is if someone left after dinning without paying bill payment, then restaurant management has some kind of reference about customer. Then other hand that will help to identify who are the regular customers visiting to the restaurant and conduct some royalty programs, in future can use that data to data mining purposes.

➢ Capture orders

When customer order confirmation then it should display on screen placed on kitchen. Then customer can take some alerts which stage in order and who are the responsible person for preparation process.

➢ Payment

After dining customer can request the bill. Then the system will generate the bill. If customer put multiple orders at once customer have option to request single bill for multiple orders or separate bill for each order.

➢ Handling promotion

Basically there has some two kind of promotions

✓ Free items promotions

If restaurant carry out item to item promotion, then the particular scenario it should be effect to inventory handling.

✓ Discount wise promotions

If restaurant carry out discounts for regular customers, then it also should have maintain record regarding discount amount for account balancing purposes.

➢ Reports & Analytics

Same as supply chain section this side should generate reports related to sales. Basically following are the reports will include to the system

- ✓ Invoice payable
- ✓ Sales summary report
- ✓ Customer report.

Within next chapter will discuss the implementation background. Basically it's contains critical review of similar systems.

2 Background

Initially proved that I have what it takes to always find solutions for problems by planning, organizing and managing problem, by doing so to guarantee successful completion of specific project goals and objectives. Effective management and technical help are required for the success of large-scale projects. Project management is all about controlling the functionalities of a particular set of tasks, but many tasks must nevertheless be performed by a human being, which includes activity plan generation, construction of process networks, and deviation of a schedule produced project monitoring. So to complete any project within a given budget, scope and time it is important to follow project management theories.

When Fine Dine system is being developing analyzed similar efforts which are already in the market. The **Fine Dine** system is a unique system because it's purely based on the requirements of the Client (restaurant). But improve features similar system analysis is must.

2.1 Similar systems
2.1.1 Waiter One

Figure 2:1: Waiter one

Waiter One package is a suite of different apps and services running on Apple's premium hardware and software.

Waiter One for iPad is available on apple app Store. Waiter one acts as a stand-alone or server version. There are no monthly costs nor subscriptions involved. Once installed on iPad can start using it right away. It also comes with a POS (Point of Sales) solution, which is considered as the heart and brain of the system, regulating all traffic from and to devices (printers, iPods/iPhones, remote iPods, KDS, cloud). Main drawback is it's only supporting to IOS devices, with compare to android devices IOS devices initial investment is high.

2.1.2 E la Carte

Figure 2:2 : E la Carte

The E la Carte is the second similar system that cover all the processes between manage and analyze. This system also provided with basic understanding of the requirements and helped to clarify certain functions of the system and also adopted functions of it to proposed system.

Here also the system is run in i-pads and has basic restaurant functions equipped within it to support basic requirements of its clients.

2.1.3 Expodine

Figure 2:3 : Expodine

Expodine is a tablet-based restaurant management system for the food, beverage, and hospitality industry, designed to save time and increase restaurant's revenue by making the process of restaurant management easier. It also helps to create repeat business and customer loyalty by building a stronger relationship with your guests and customers. Expodine main advantage is it's enables real-time tracking of restaurant's performance by analyzing the current, daily, weekly, monthly, and yearly sales data categorized by different delivery modes ranging from dine-in, takeaway, and home delivery. But limitation is there has no feature to forecast future trends.
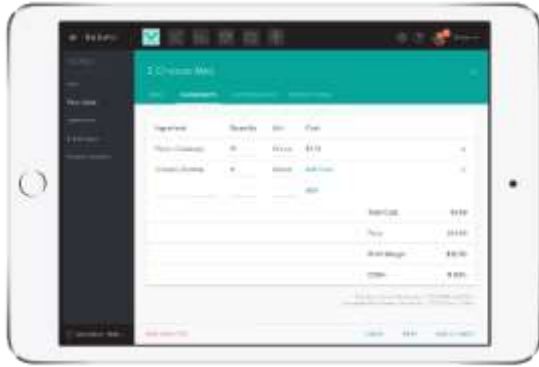
2.1.4 PeachWorks

Even Patchworks also the restaurant management system which includes same functionality on expodine.

Figure 2:4 : PeachWorks

2.1.5 Aldelo

Aldelo also the restaurant point of sale and management solution empowers restaurateurs to achieve simplicity and efficiency.

Figure 2:5: Aldelo

The competitive Systems are designed mainly for common use and these systems do not specifically address the solutions for the unique requirements within the organizations. Also these some systems run on IOS and are only compatible with IOS devises such as i-phones and i-Pads which are expensive in terms of the Hardware.

The specialty of the **FineDine** System is that it is specifically created to suit the Sri Lankan restaurants. For example the E la care system offers bill payments by android app. Is a situation giving the customer the bill payment might not be the best idea. Because the system cannot detect whether the customer has paid or not. In a situation the customers could exploit this and leave without paying.

System design is the process of designating the fundamentals of a system such as the architecture, modules and components, the different interfaces of those components and the data that goes through that system. It is meant to satisfy specific needs and requirements of a business or organization through the engineering of a consistent and well-running system. With next chapter will discuss how fine dine system will design based on the customer requirements.

3 System Analysis and Design
3.1 Current Process
There are two kind of restaurants

- ✓ Waiter based restaurants
- ✓ Self-service restaurants

3.1.1 Waiter based restaurants –Current process

Entering to the restaurant the customers are instructed to be seated in a table or directly approach the ordering table where the cashier is located after being seated the menu card to be brought to them by a waiter who will provide them with the menu card which includes all the food items in place. Then customers have to read the menu card to find what they wants, then the customer can order by orally telling the waiter and the waiter has to write it down on paper. Then the waiter has to approach the ordering table where the cashier is. Then the waiter has to ask the table staff to send the order to the kitchen by writing down a chit on a piece of paper. Once the order is been sent to the kitchen, the kitchen staff has to pin it down to a notice board according to the incoming order. Then each kitchen staff member takes notice down and start preparing the food in the order. After the order is being finished and put in trays, and hand over the trays to the waiter through a window. Then the waiter has to collect the bill from the cashier and serve the food to the table. After finishing dining the customers has to pay the amount in cash or card.

3.1.2 Self-service restaurants – current process

When customer came to the restaurant he or she need wait in the queue until become a chance to buy foods. Most of time customer will not decide what he or she wants to buy until come front of the queue. In busy hours that will effecting to long queue in restaurants. Then he or she order foods looking the screens behind the cashier and cashier will entering the bill simultaneously. So after putting order cashier inform order details to kitchen staff by orally. After finishing preparing food they inform to cahier orally and cashier will inform to customer orally.
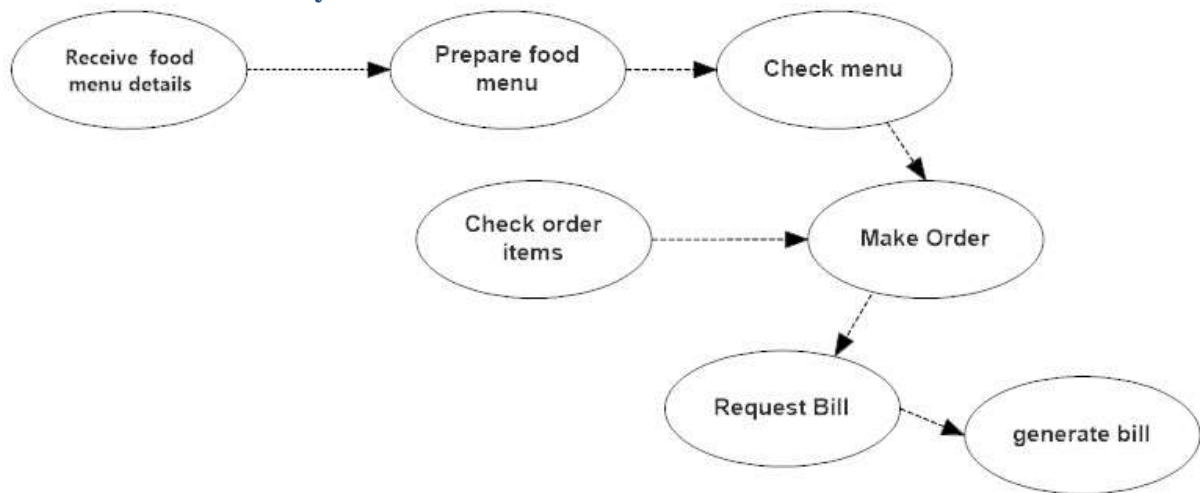
3.1.3 Business Activity Model

Figure 3:1: Current Business Process

3.1.4 Drawbacks of the current system

The current system implemented in traditional restaurants have following drawbacks.

Main drawbacks identified

- ✓ The method of providing the information regarding the food items (menu)
- ✓ The customer ordering process and order alteration process.
- ✓ Piling of Kitchen workload.
- ✓ No proper mechanism to recode customer feedback and inquiries.
- ✓ No way to calculate production cost of food.

3.1.4.1 The method of providing the information regarding the food items (menu)

The manual system facilitated the requirement of delivering method of providing the information regarding the food items through a menu card provided by the waiter after customer seating in the table. Also restaurants displayed an LED screen showcasing the food items for its customers for further guidance.

The problems faced

- ✓ The customers were asked to be seated for a while until the waiter provides the menu card which is time consuming. This results in both the inconvenience for the customer and waiter.
- ✓ In a busy day the waiter has to cover more tables in a limited time duration which is exhausting.

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- Also to cover the tables by waiters it requires manual labor which is expenditure in terms of the management of the restaurant.
- In a situation of an elderly person being the customer he or she was unable to read the menu because the letters were too small. Also after placing the ordering the customers had to approach the receptionist to request the menu card again if further ordering was needed.

3.1.4.2 The customer ordering process and order alteration process
The method of ordering of the food was mainly based on a manual routine involving the waiters

Here once the customer decides the necessary food items, he or she waits for a waiter to take their order. Then the waiter is requested to note down the customer request and report it back to the kitchen or the customer could also directly approach one of the staff members in the ordering table and from there the customer could order according to the preference.

Order alteration process

In an even of alternating or canceling an order the customer is requested approach the service table and make necessary changes.

The problems faced

- The waiter had to take orders of every table. In a busy day the waiter has to cover more tables in a limited time duration which is exhausting.
- The waiter has to write down the order, and in that situation there occurs problems.
- Such as the customer order could me miss understood and taken down, also the hand writing of the waiter should be good otherwise the kitchen will have problems reading it.
- When needed to alter the order one must go to the ordering table
- In an event of altering the order the customer might not be able to make the alterations by the time the alteration reaches the kitchen it will be cooking started

3.1.4.3 Piling of Kitchen workload

The busiest place in restaurant is the kitchen and it should be functioning properly without any delays or hindrance to support the customer efficiently. The method of informing the kitchen with the customer orders is done by placing orders by assigning each food item to the staff by oral communication and then written slips with a number which are sent to the chef are placed in a notice board. Once the staff member is done preparing the food item he calls the waiter by referring the number in the slip. Then he takes down the slip in the notice board

The problems faced

- ✓ Lack of communication

    The method of assigning orders to the staff using warble communication is really messy and this cause the orders to be miss placed miss read miss order, and also this will result in two staff members preparing the same dish.

- ✓ Highly unprofessional

    The shouting and calling cause dissatisfaction among the customers and the quality of service.

- ✓ Slips

    The written slip is being placed by the ordering table and this needs separate resources and man power to be done which is a waste.

- ✓ Food items being mixed

    A staff member will be getting multiple number of food items to prepare, the slips of each food item are placed in a notice board and these slips can be mix with each other resulting in the order being containing unwonted food items.

- ✓ Leaving the kitchen

    The finished orders has to be sent to the customer tables quickly in such a case waiting for the waiter to come back to the kitchen is time wasting.

3.1.4.4 No proper method to recode customer feedback and inquiries

The customer feedback is a valuable information source for the management of the restaurant.

With the current manual system pizza mania had no customer feedback recording system.

The problems faced

- ✓ The customers had no proper method to file an complain about the service
- ✓ The management lacked a source to build the organization customer friendly.
- ✓ Didn't have a method to identify the drawbacks of restaurant.
- ✓ Other competitors benefitted for this because the customer felt safe and confident of other competitors who got customer feedback.

3.1.4.5 No way to calculate production cost of food.

If we going make a food, restaurant know the recipe of the particular food item. So based on that we can calculate how much the cost for the single item. When consider the current system there has no way to calculate that cost.

3.2 Functional and nonfunctional requirements

3.2.1 Functional Requirements

- ✓ Shall be able to crate user accounts with different privileges
- ✓ Shall be able to make order in efficient manner.
- ✓ Shall be able to organize kitchen workload.
- ✓ Shall be able to direct communication between chef and customer.
- ✓ Shall be able to handle special promotions.
- ✓ Shall be able to take managerial reports.
- ✓ Shall be able to capture customer details without any annoy.
- ✓ Shall be able to capture organized data for future decisions.
- ✓ Shall be able to control the inventory.
- ✓ Shall be able to manage bill of material.

3.2.2 Non-functional requirements

- ✓ Shall be able to link with existing POS system (Point of sales system)
- ✓ Shall provide friendly GUI
- ✓ Should have web interface.

3.3 Proposed solution

The problems of restaurants were analyzed in the initial requirement analysis and the problems were mainly located in the processes.

To counter these problems we suggest a mobile application system which allows automated solutions for certain selected functional requirements. These solutions are divided into two problem sections as **Order management system** and **Supply chain management system.**

3.3.1 Order management system

3.3.1.1 Customer solution (Mobile application)

When the customer enters the restaurant. He or she is asked to be seated in a table in his or her choosing. Or directly approach the ordering table (cashier) if so the customer will be allowed to place the order by viewing the information on the screen in the ordering table. There the food items are displayed and the cashier will place the order using the same mobile application.

If the customer decides to be seated, a Tab is been kept on the table for customer use. This tab allows customers to View available food items and beverages. Then the tab allows to view specific ingredients, quantity and preferences of the food items.

Once the customer selects the food item he or she is permitted to order the food items be adding them to a cart where all the information of the order is displayed as number of food items, price of an item and the total price of the order. Then the customer can also make changes and alter the order. Then the customer is requested to finalize the order by confirming the selected food items.

Then order is placed according to the table the customer is seated each table consists with a unique number and that number is the primary source to locate the order (The order is linked with the system through the table number).

Once he or she order is being updated to the kitchen where a wide screen is installed to show the waiting queue of the orders and the kitchen staff is asked to refer the food items form the screen. The orders are being placed in a first come first serve basis and the new orders are being placed to a ready queue by a scheduler. Once the order is being assigned to a staff member it automatically sends the customer that the food is about to be prepared.

Once the food items for an order is prepared the staff member can take down the order form the screen and move on to the next order. When that happens the system will update the cashier with the information relevant to the order and form the cashier the bill is being generated afterword's the waiter is asked to collect the order and the bill to bring it to the table for the

customer. Before leaving the table the customer is given the opportunity to give his feedback of the service of restaurant where the customer can file a complaint, suggest areas of further improvements or his rating of the restaurant.

3.3.2 Web solution
The web solution is divided into three sections this is coordinated using a web application.

- ✓ Admin/master   module
- ✓ Kitchen module
- ✓ Billing module

3.3.2.1 Admin /master module
Admin /master module provides following features

- ✓ Create / update user accounts
- ✓ Manage user privileges
- ✓ Create .update master data which required to put order.
- ✓ Taking management reports.

3.3.2.2 Kitchen module
When the customer put order it should directly transfer to the kitchen to prepare the foods. Main functionality here in make collaboration with kitchen and customer. This scheduler allows a kitchen staff member to view the pending orders & update the order status then he has to assign the Staff members with each order.

3.3.2.3 Payment module
This allow cashier to view the ongoing orders and & print the final bills.

3.3.3 Supply chain management system
Supply chain management system basically have two sub components.

- ✓ Inventory controlling module
- ✓ Bill of material creating module.

3.3.3.1 Inventory controlling module
When comes to the restaurant management inventory may be one of least favorite tasks, but it's crucial to controlling restaurant's food costs and reducing waste. Scheduling and performing regular inventories can also increase restaurant profits by over 20% each year because it keeps from over-ordering. Restaurant food inventory management is connected to everything from planning menu to determining how many guests you can feed, making it essential to the daily operation of any foodservice business.

3.3.3.2 Bill of material creating module

When considering food industry bill of material is important tool also known as the BOM or recipe. The bill of materials is a listing of the raw materials and work in progress and the quantities of each needed to manufacture a finished product.

3.4 Hardware software requirement

3.4.1 Development environment

	Component	Minimum System Requirements
Hardware Requirement	Processor	Intel core i3-2350M CPU @2.30 GHz
	RAM	DDR 3 8 GB
	Hard disk	160 GB or higher
	Power	Redundant suitable secondary Power source (Minimum up time 99%)
	Monitor	HP LED 19 inches
	Android Tablet	Android tablet , android version 6 or greater
Software Requirement	Developing software	Visual studio 2017 VS code Post man IIS 10 Google chrome 44 Android studio
	Framework	.net core 2.0 Android SDK 16
	Database server	Microsoft server 2014
	Reporting Tool	Power BI
	Hosting environment	Microsoft azure server
	Mobile emulator	Android studio emulator

Table 3:1 : Development environment requirement

3.4.2 Client environment

3.5 Methodology

	Component	Minimum System Requirements
Hardware Requirement	Processor	Intel Pentium 4
	RAM	DDR 1 2 GB
	Hard disk	160 GB or higher
	Table tablets	Samsung galaxy Tablet android version 6
	Printers	Epson TM-m10
	Monitors	49 inches Samsung LED TV HD HP LED 19 inches
Software Requirement	Basic software	Google chrome version 44
	Database server	Microsoft server 2014
	Hosting environment	Microsoft azure server

Table 3:2 : Client environment requirements

3.5.1 Agile metrology

Agile is a time boxed, iterative approach to software delivery that builds software incrementally from the start of the project, instead of trying to deliver it all at once near the end. It works by breaking projects down into little bits of user functionality called user stories, prioritizing them, and then continuously delivering them in short two week cycles called iterations. Following are the iterations plan to do.

Iteration 01 – Configure architecture with reusable components.

Iteration 02 – Developing admin module.

Iteration 03 – Developing Master Data module.

Iteration 04 - Developing customer Solution.

Iteration 05 – Developing Kitchen module.

Iteration 06 – Developing payment module.

Iteration 07 – Developing bill of material module.

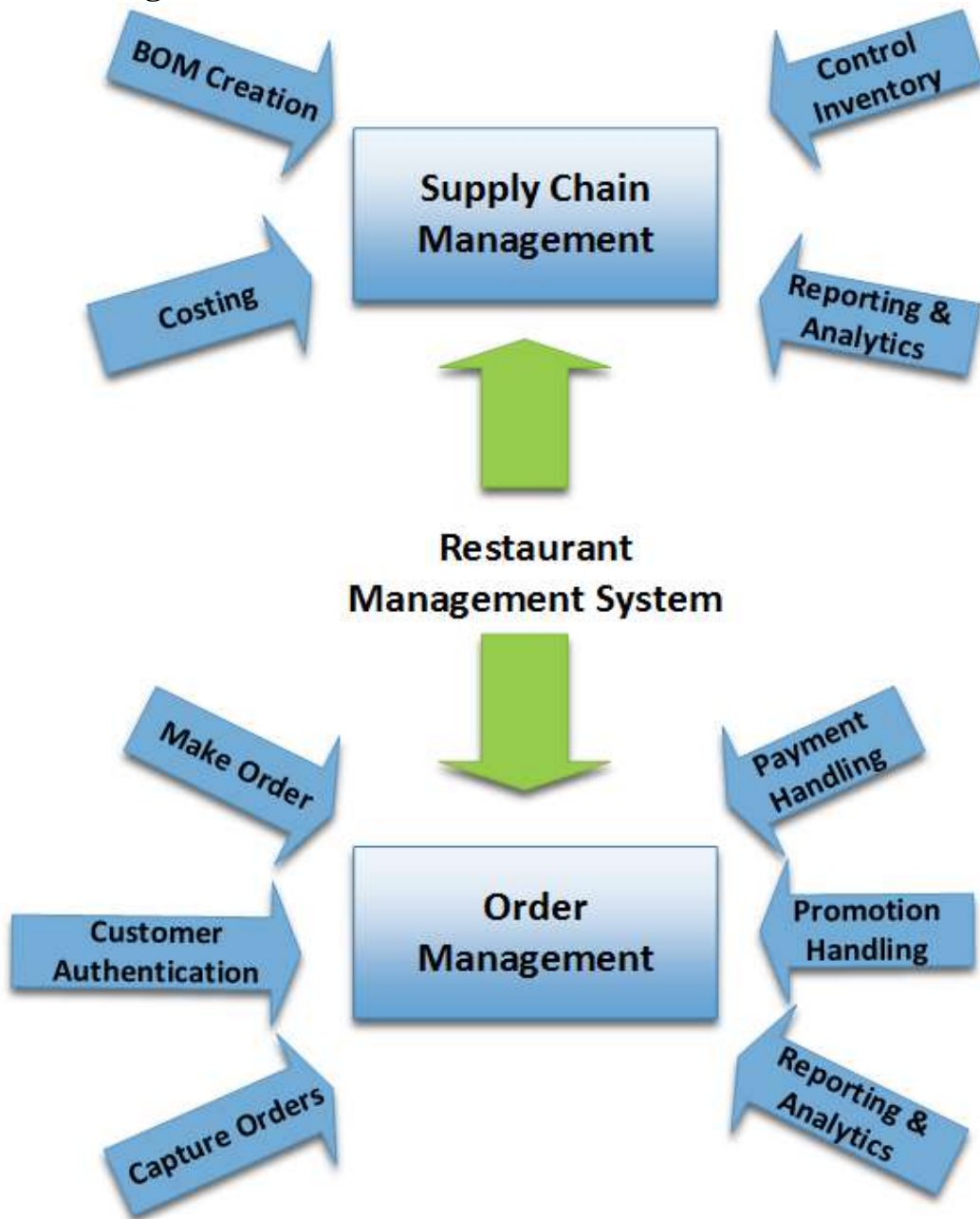Iteration 08 - Developing inventory control module.
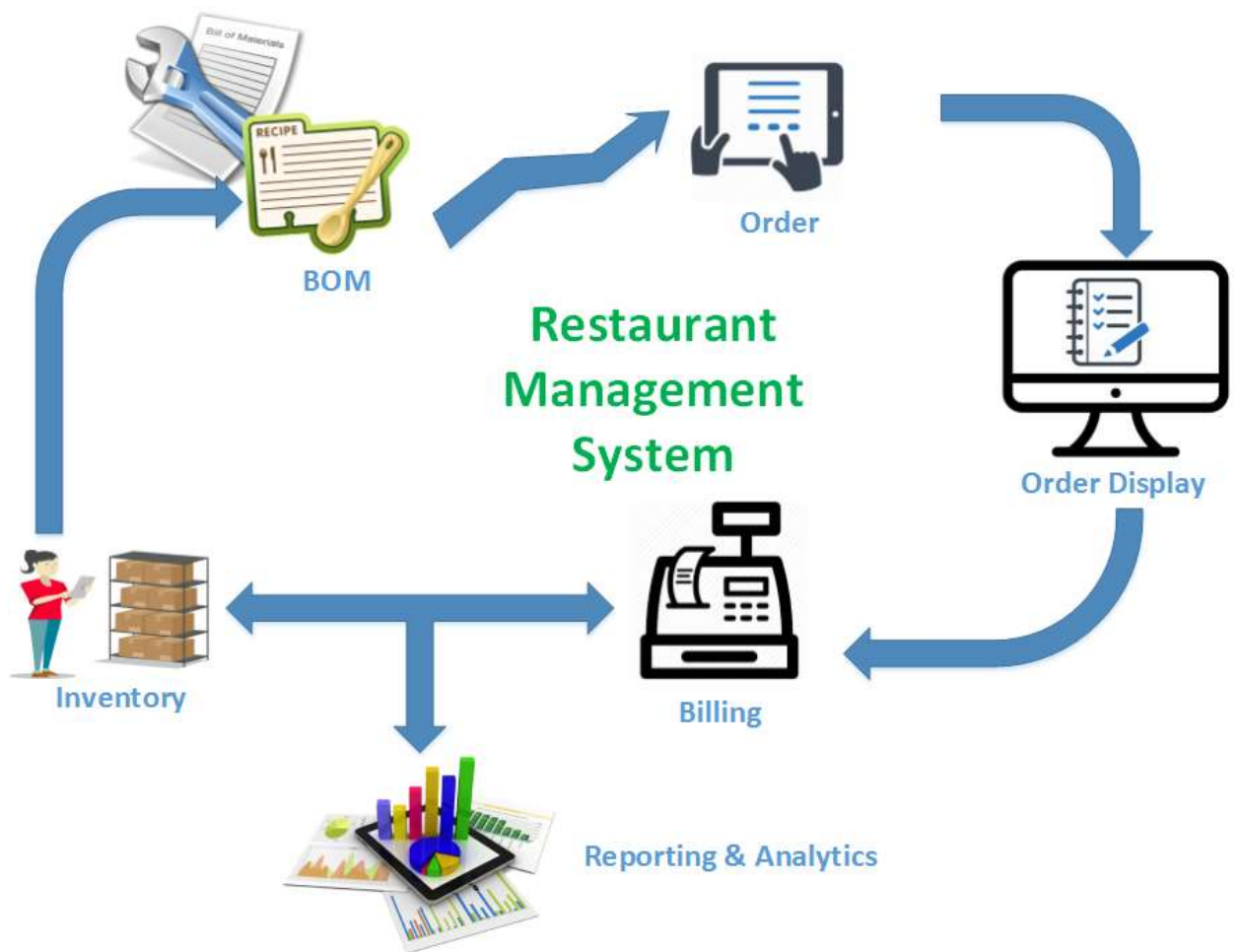
3.6 Design

Figure 3:2 : Basic structure

Figure 3:3: Overall design

3.6.1 Use case Diagram
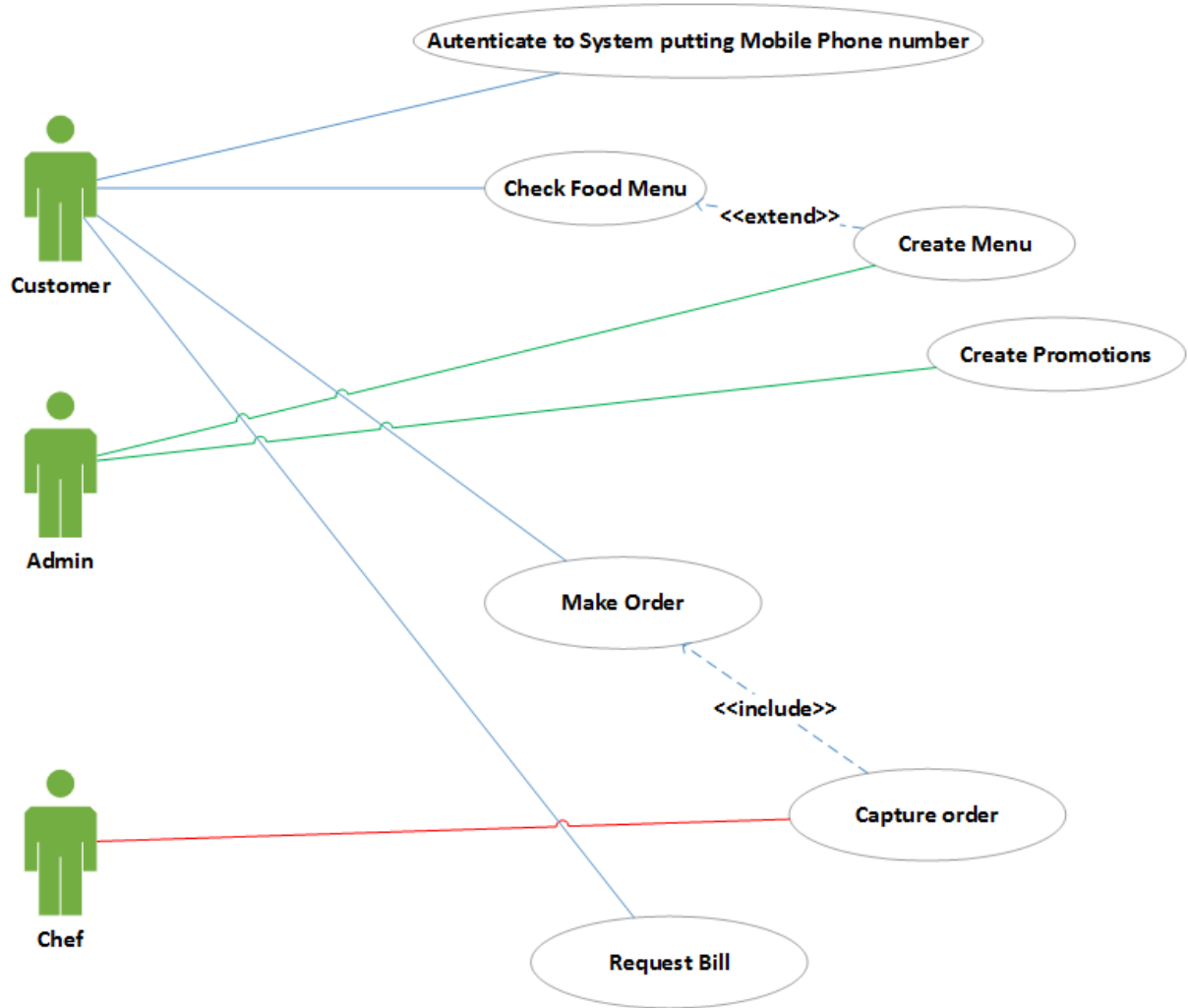### 3.6.1.1 Customer solution

Figure 3:4: Use case 01- Customer Solution
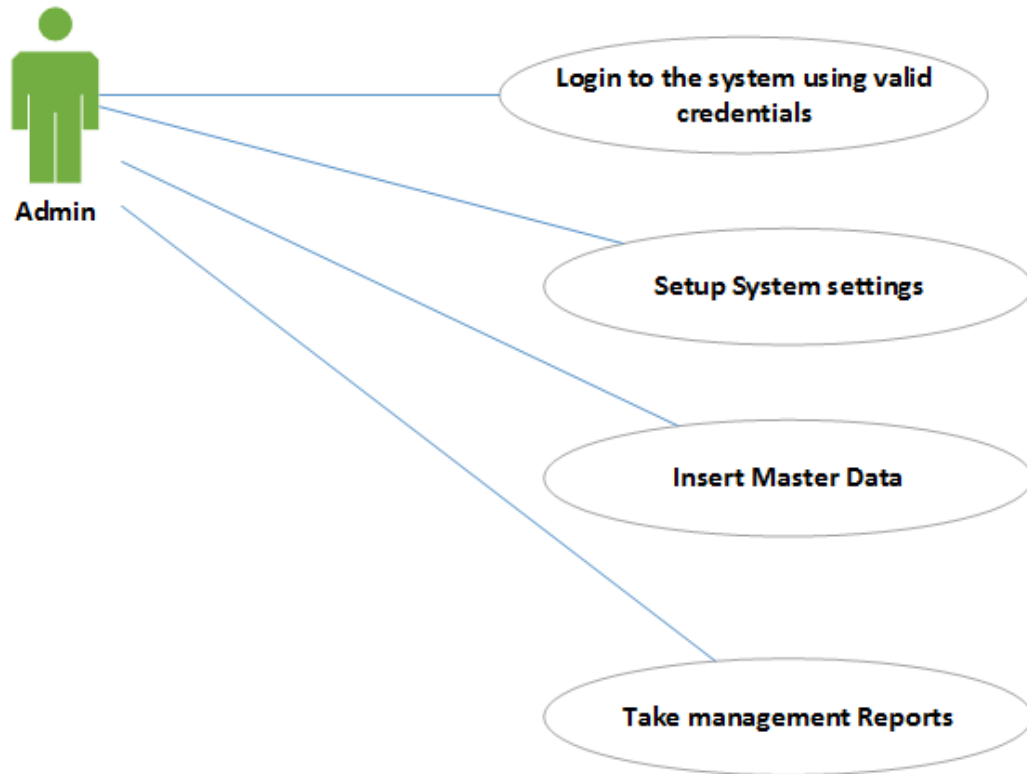
3.6.1.2 Admin/master module

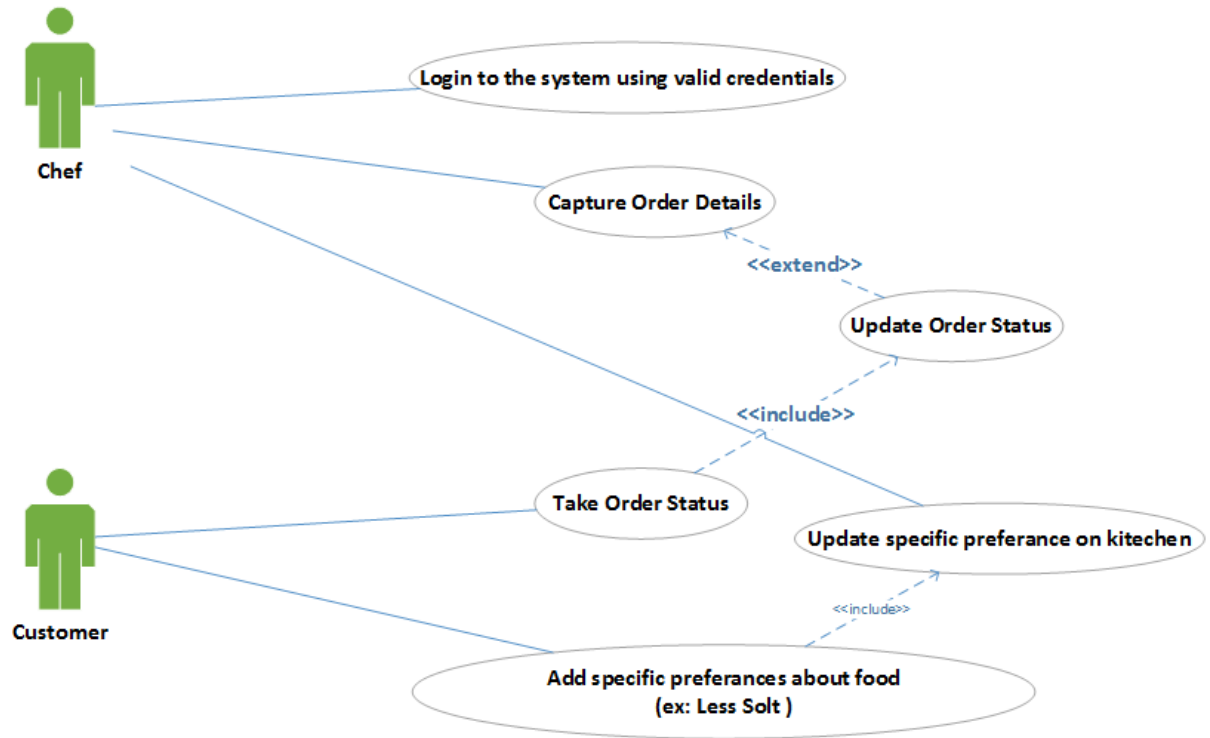*Figure 3:5 : Use Case 02- Admin Module*

3.6.1.3 Kitchen Module

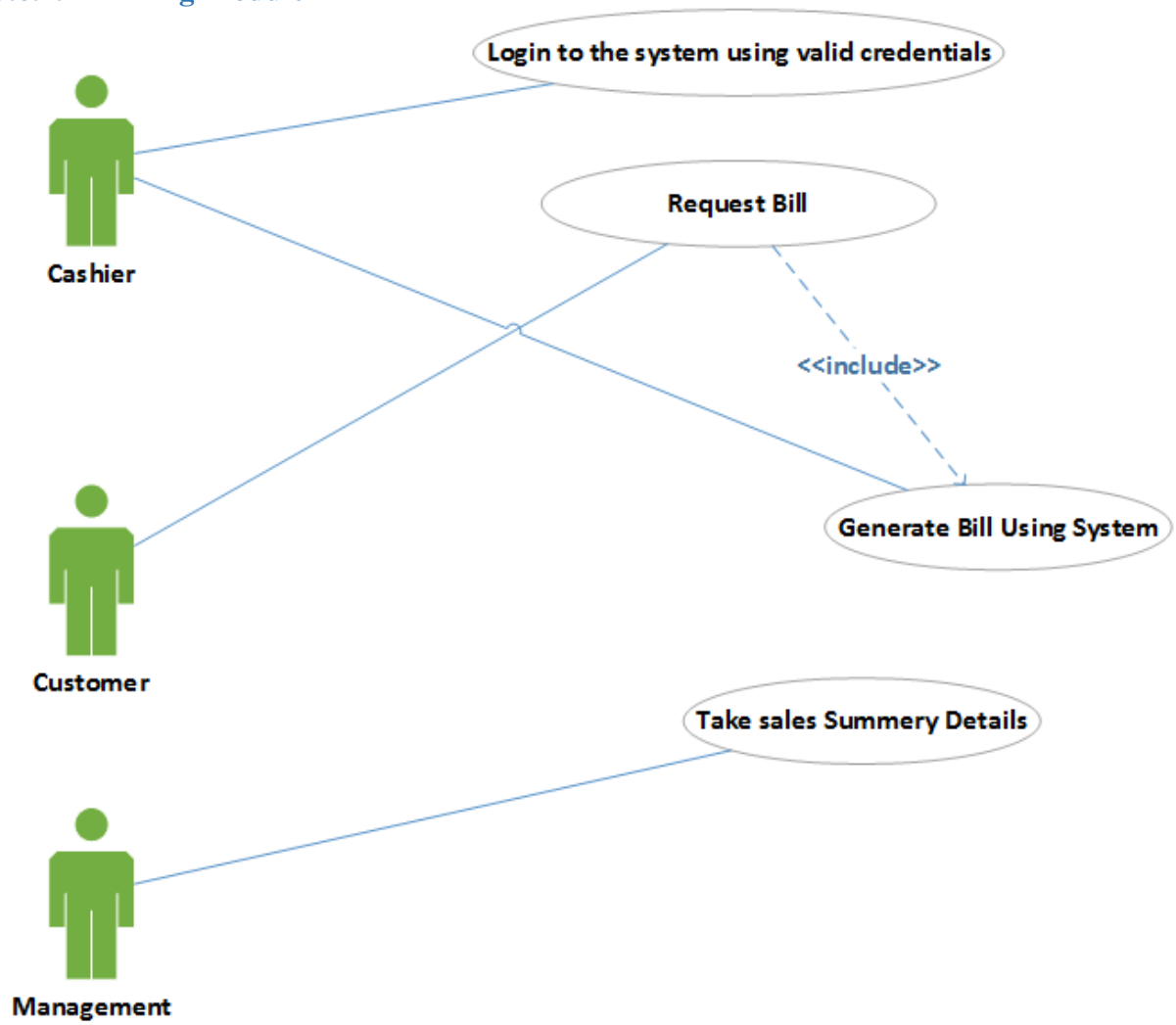*Figure 3:6: Use Case 03 -Kitchen Module*

3.6.1.4 Billing Module

Figure 3:7 : Use Case 04- Billing module

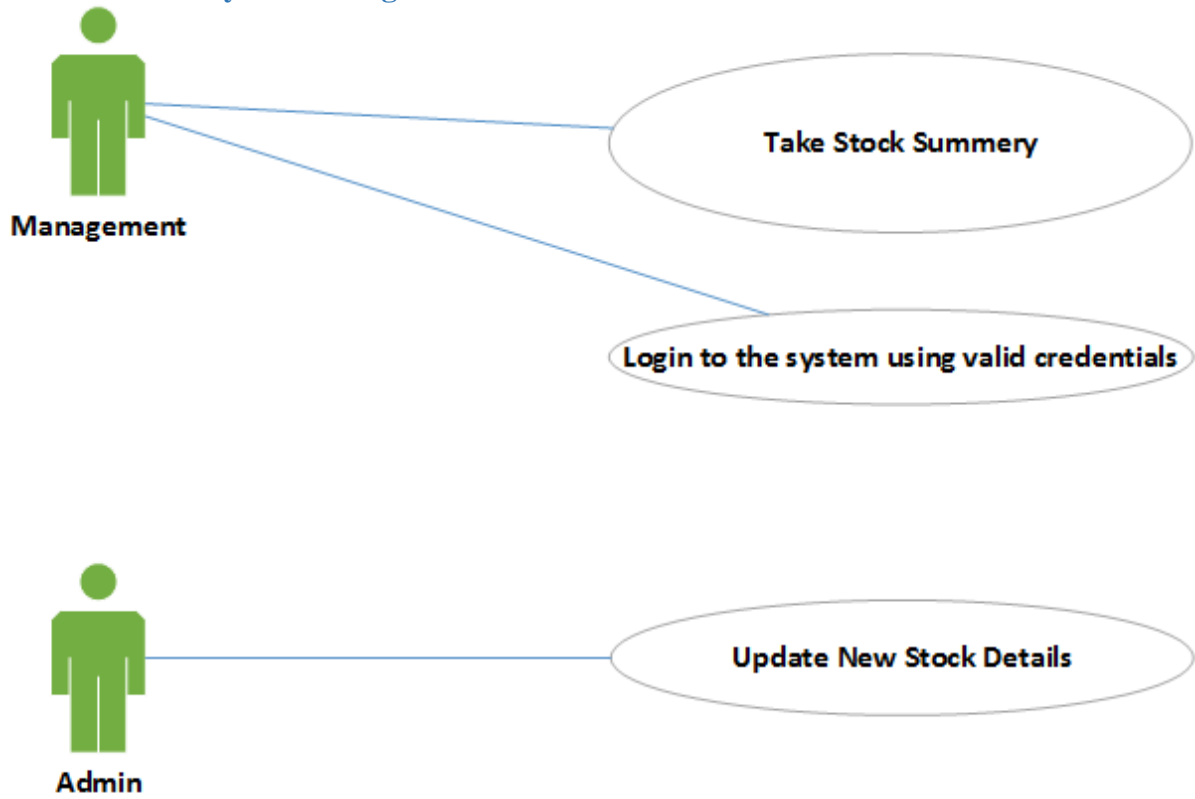### 3.6.1.5 Inventory controlling module

Figure 3:8 :Use Case 05- Inventory Control
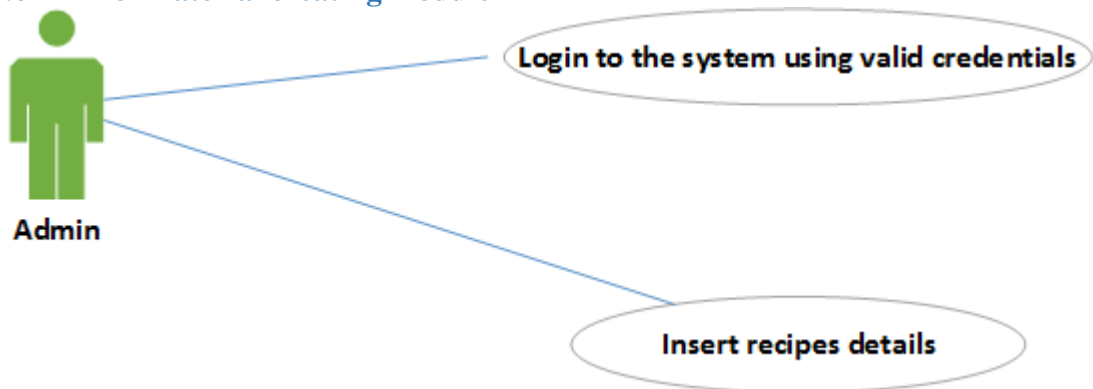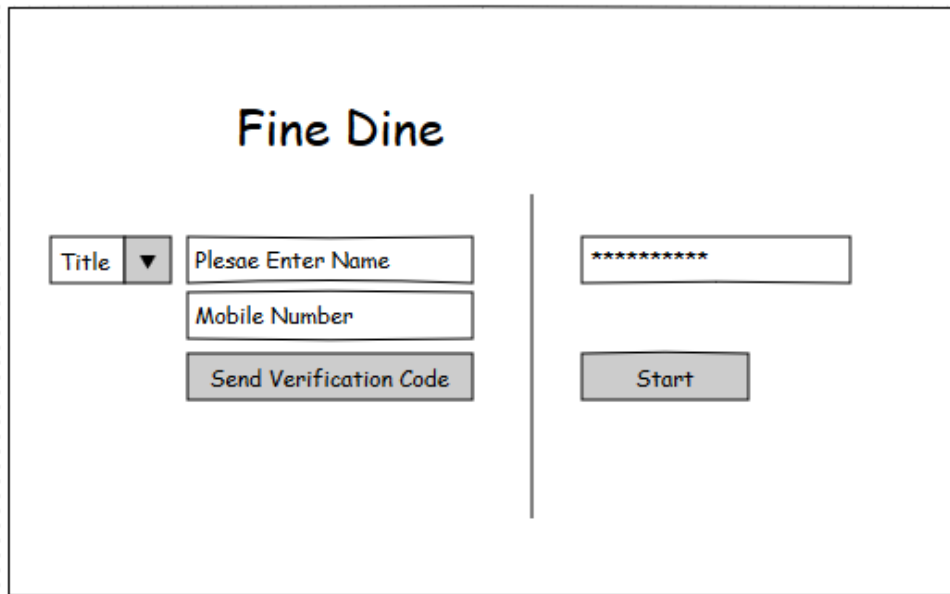
3.6.1.6 Bill of material creating module

Figure 3:9: : Use Case 06 - BOM

3.6.2 Database Design

Figure 3:10 : ER Diagram

3.7 User Interface Design
3.7.1 Mobile Solution
3.7.1.1 Customer login
When customer came to the restaurant he or she need to take access token putting mobile phone number. Following interface use to achieve particular task.
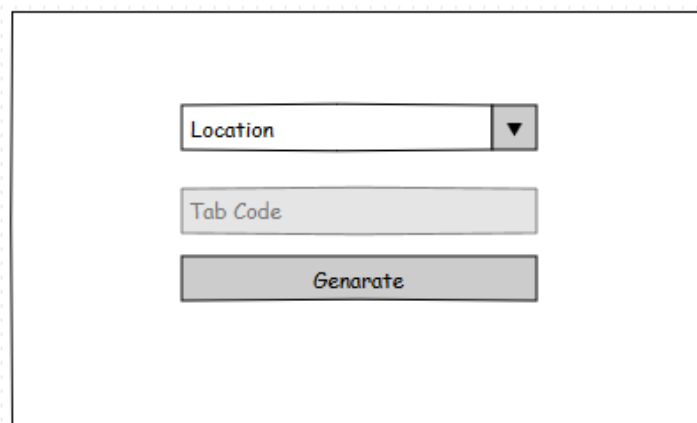

Figure 3:11 : Customer Login

3.7.1.2 Tab Registration
If restaurant have multiple branches, then need to identify particular tab belongs to which branch. Following interface use to active that task.

Figure 3:12 : Tab Registration

3.7.2　Web Solution
3.7.2.1　Location Master
Following interface use to insert restaurant branches details

Figure 3:13 : Location Master

3.7.2.2　Employee master
Following screen use to insert restaurant employee's basic details.

Figure 3:14 : Employee Master

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3.7.2.3 Activate Tab

If currently order running tab will unexpectedly stopped, then particular running order need to assign to another tab. Following interface use to achieve that task.
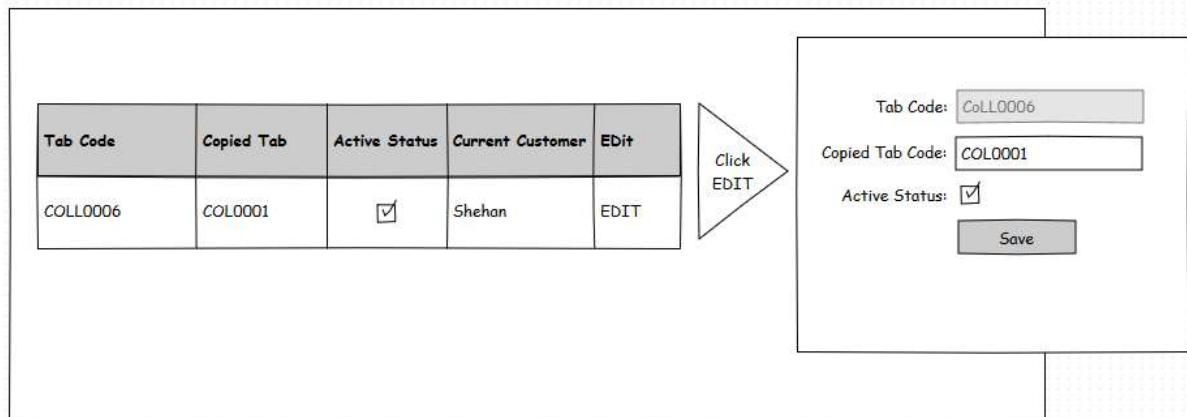
Figure 3:15 : Activate Tab

Software implementation is most important chapter in this document. Within next chapter contains the aspects such as selection of implementation technology (languages, platforms frameworks, platforms etc.) and the justification for the choices.

4 Implementation

4.1 Architecture

Software application architecture is the mechanism of outlining a structured solution which meets all of the technical and operational requirements, while boosting common quality aspects such as performance, security, and manageability. It associates a set of arrangements based on a wide range of circumstances, and each of these circumstance can have appreciable impact on the quality, performance, maintainability, and overall success of the application. Below image shows the how FineDine System organized.

[6]
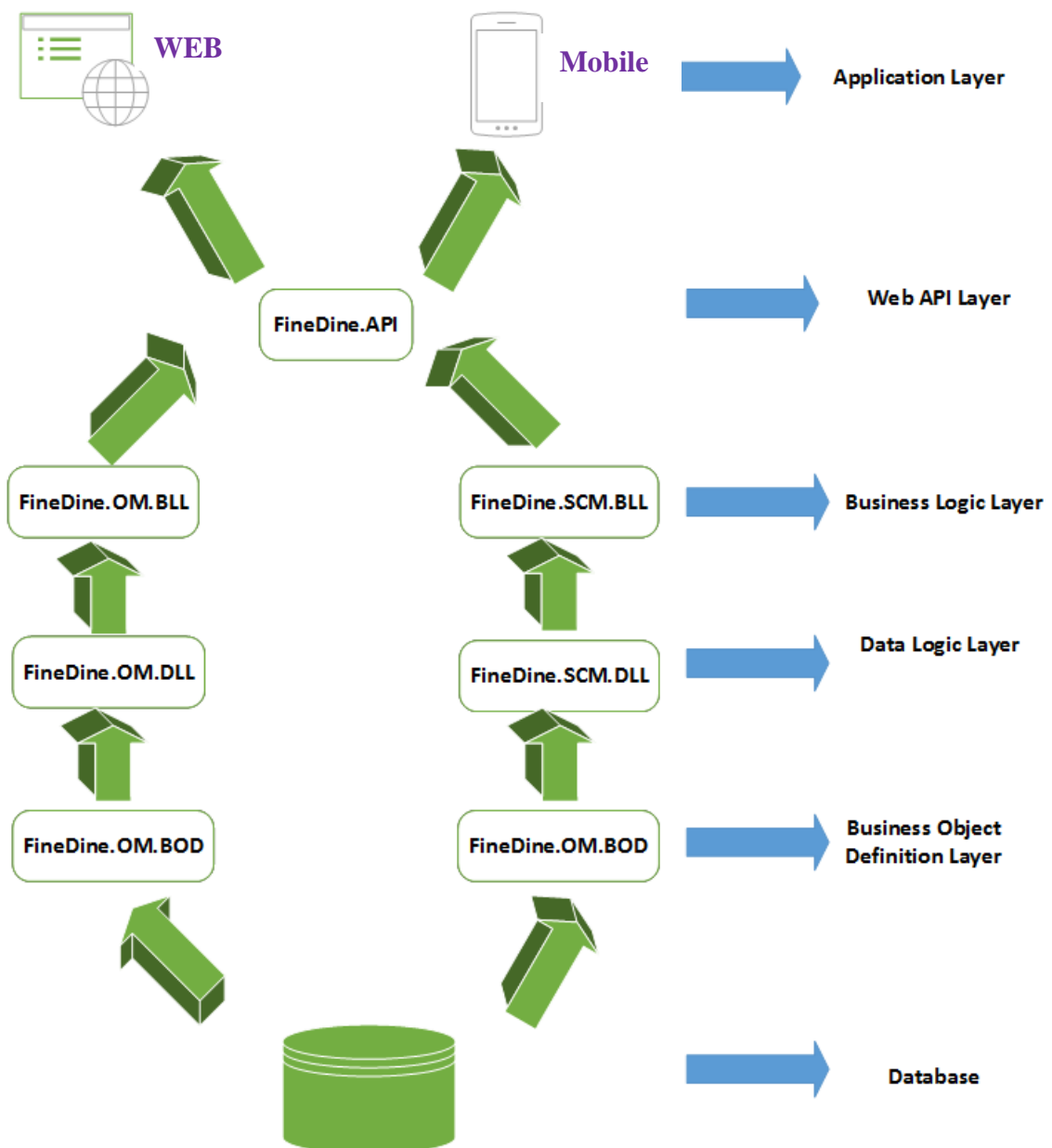
Figure 4:1 : Architecture

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4.1.1   Technologies used

When developing **FineDine** System it includes two major implementations.

- ✓ Web implementation
- ✓ Mobile implementation

4.1.1.1   Web implementation

When implementing web solution **Asp.Net** was used as the based language and following technologies and frameworks used to build up system.

- ✓ **ASP.NET Core 2.0**

  The ASP.NET Core MVC framework is a lightweight, open source, highly testable presentation framework optimized for use with ASP.NET CoreASP.NET Core MVC provides a patterns-based way to build dynamic websites that enables a clean separation of concerns. When developing project backend, it's   totally build on under MVC core platform following software engineering principles.

  - ✓ **Angular 4**

  Angular is a structural framework for dynamic web apps. It lets use HTML as template language and let's extend HTML's syntax to express application's components clearly and succinctly. Angular 4 data binding and dependency injection eliminate much of the code would otherwise have to write. And it all happens within the browser, making it an ideal partner with any server technology. When developing project frontend it's totally deepened on angular 4 framework. Main advantage of the framework is **consistency**, because overall framework is based on components and services and also it supports rich code maintainability.

  - ✓ **SQL Server**

  SQL (Structured Query Language) is a standardized programming language used for managing relational databases and performing various operations on the data in them. When implementing system SQL became as key database language and SQL server management studio 2014 used for configuring, managing, and administering all components within Microsoft SQL Server.

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✓ **Entity framework**

Entity Framework (EF) is an object-relational mapper that enables .NET developers to work with relational data using domain-specific objects. It eliminates the need for most of the data-access code that developers usually need to write. When developing system data layer totally handled using entity framework database first approach.

✓ **Asp.net web API 2**

ASP.NET Web API is a framework which provides easy to build HTTP services which reach a wide range of clients, including browsers and mobile devices. ASP.NET Web API is an ideal platform for building Restful applications. Within my projects all the client requests was handled using web APIs and with comparing traditional web services it provides lightweight data communication services.

✓ **Single page applications**

When considering project backbone it's designed based on single page application concept. When considering traditional web applications server always send new html pages based on clients request and this technology provides that load a single HTML page and dynamically update that page as the user interacts with the app.

Traditional Applications
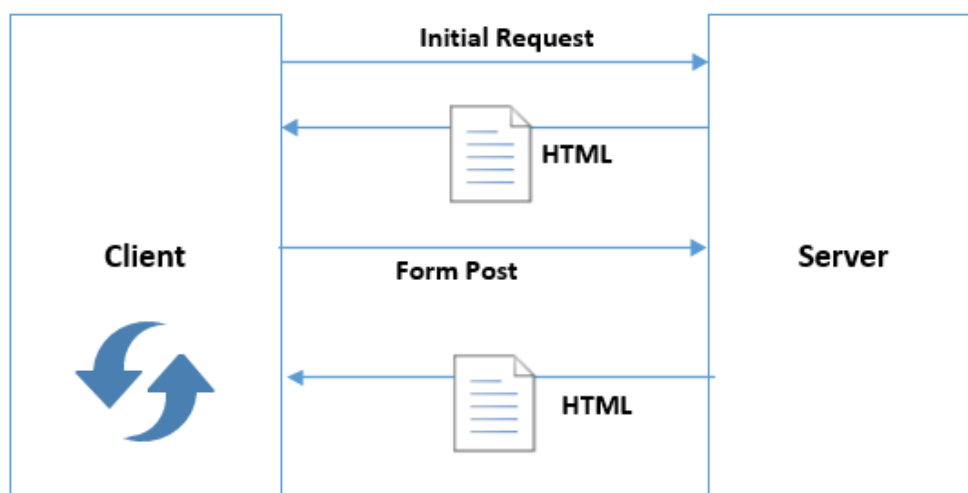
Figure 4:2: Traditional applications

Single page applications
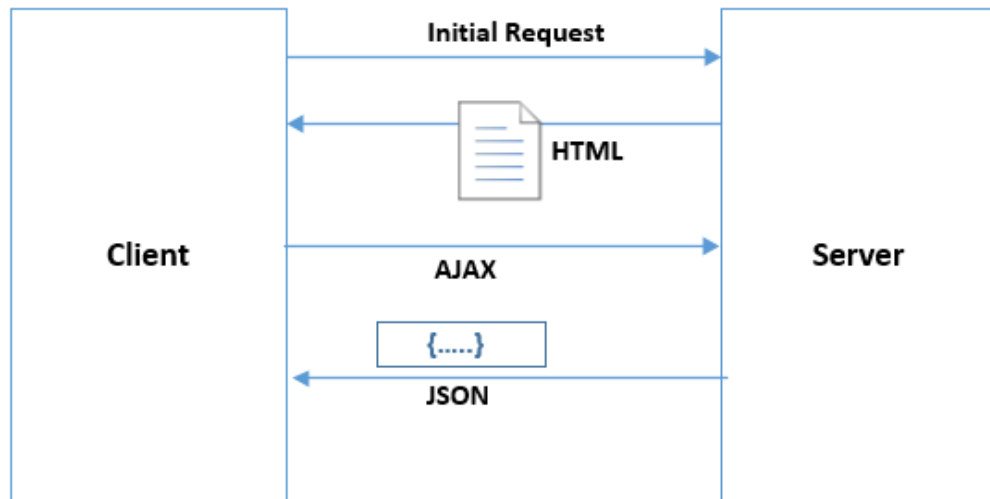
Figure 4:3: Single page application

4.1.1.2 Mobile implementation

When developing mobile application Ioinc 3 framework used as the base framework and web APIs used to integrate Asp.Net backend.

✓ **Ionic 3**

Ionic is an HTML5 mobile app development framework targeted at building hybrid mobile apps. Hybrid apps are essentially small websites running in a browser shell in an app   that have access to the native platform layer. Hybrid apps have many benefits over pure native apps, specifically in terms of platform support, speed of development, and access to 3rd party code.

4.2 Security architecture
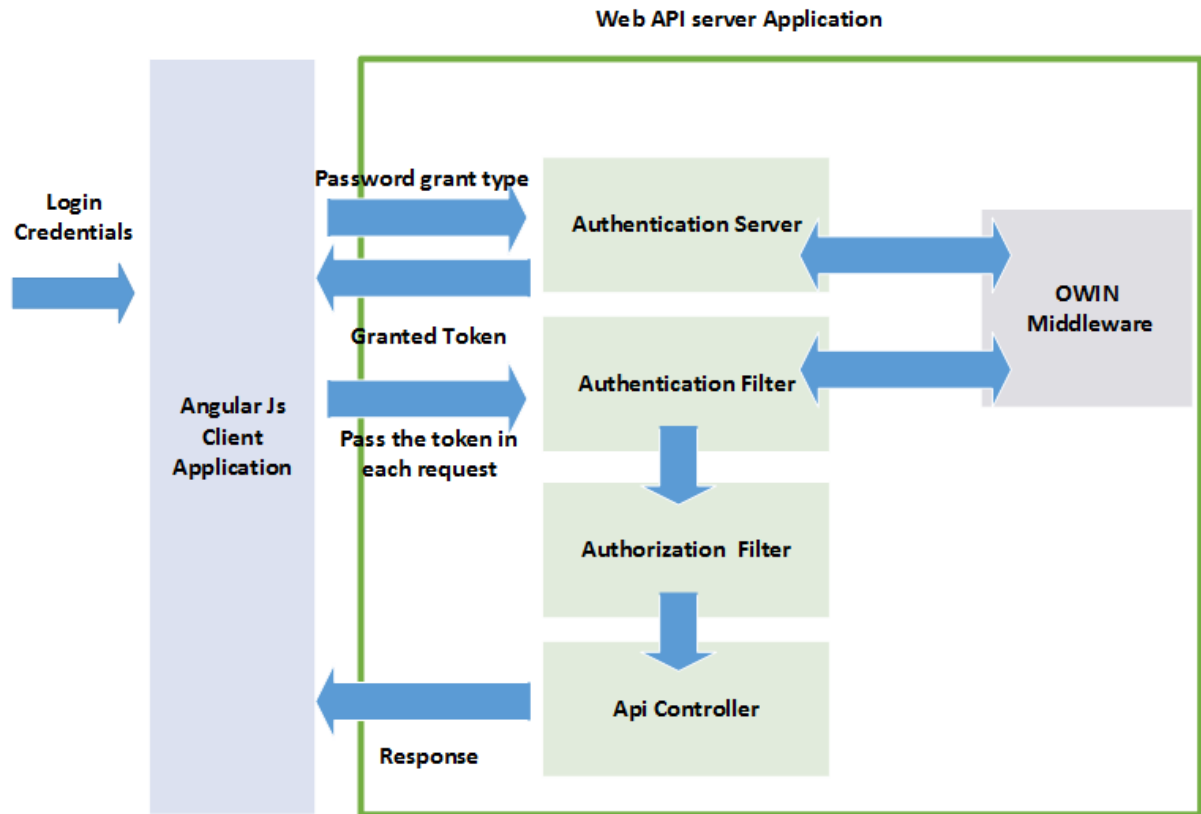
Figure 4:4: Security Architecture

Token based authentication allow client application to access the restricted resources of a server side application. Token based authentication uses a bearer token between client and server to access the resources. And to get the token, client application first send a request to Authentication server endpoint with appropriate credential. If the username and password is found correct then the Authentication server send a token to client as a response and the client application then use the token to access the restricted resources in next requests. ASP.Net Web API uses OWIN OAuth middleware for Authentication server operations.

4.3 Design Patters

4.3.1 Dependency Injection

This follows the Dependency Inversion Principle, which states that "high level modules should not depend on low level modules; both should depend on abstractions." Dependency Injection (DI) is a design pattern which exposes how to create loosely coupled classes. When comes to the term "tight coupling", when says two classes are tightly coupled which refers that linked with a binary association. As an example two classes, Class1 and Class2, that are joined together as an aggregation. This is shown in the following code.

```
public class Class1
{
    public Class2  Class2  { get; set; }
}
public class Class2
{
}
```

When Class1 and Class2 were loosely coupled, Class1 would have a reference to an interface instead of a direct binary reference to Class2. This is shown in the following code.

```
public class Class1
{
    public IClass2 Class2 { get; set; }
}


public interface IClass2
{
}


public class Class2 : IClass2
{
}
```

When comes to ASP.NET Core MVC which provide inbuilt dependency injection for implementation.

4.3.2   Repository Pattern

The repository pattern is anticipated to build an abstraction layer between the data access layer and the business logic layer of an application. It is a data access pattern that prompts a more loosely coupled approach to data access. Here I going to create the data access logic in a separate class, or set of classes, called a repository with the responsibility of persisting the application's business model. Basically here using repository pattern with database first approach.
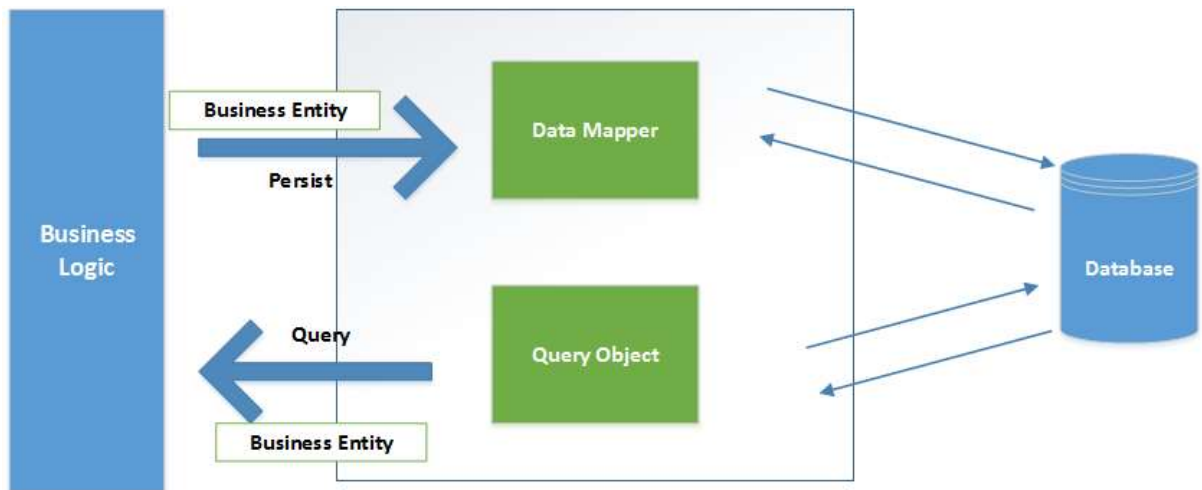
Figure 4:5 : Repository Pattern

4.4 System components implementation

As discussed above system carried out for two major implementations

- ✓ Web application implementation
- ✓ Mobile application implementation

Following are the some major components of those implementation.

4.4.1 Master data forms
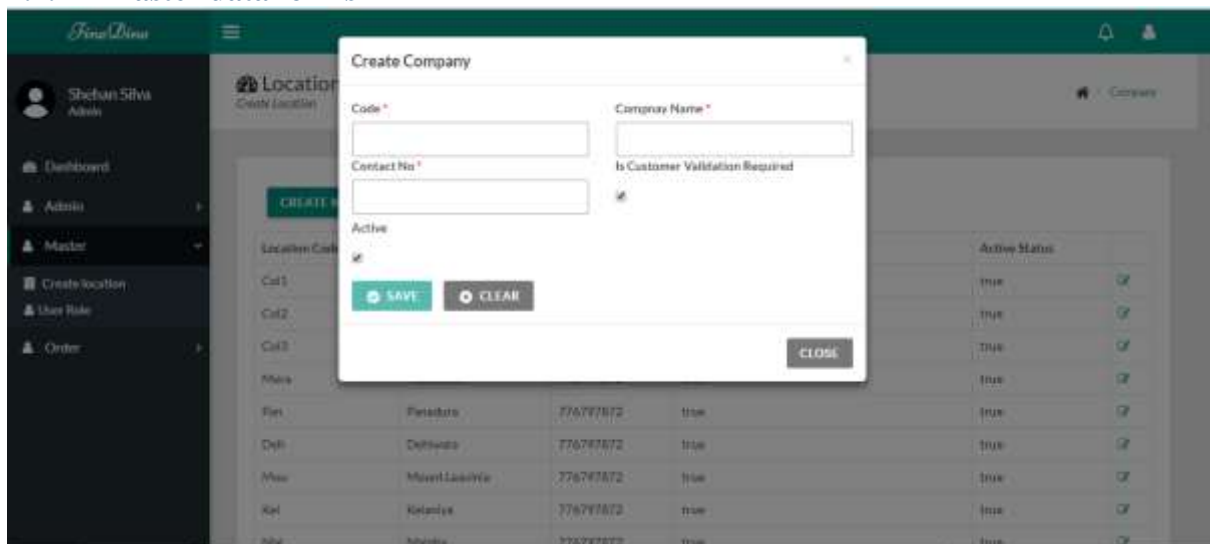
Figure 4:6: Location master

Above interface use to create restaurant location.

34
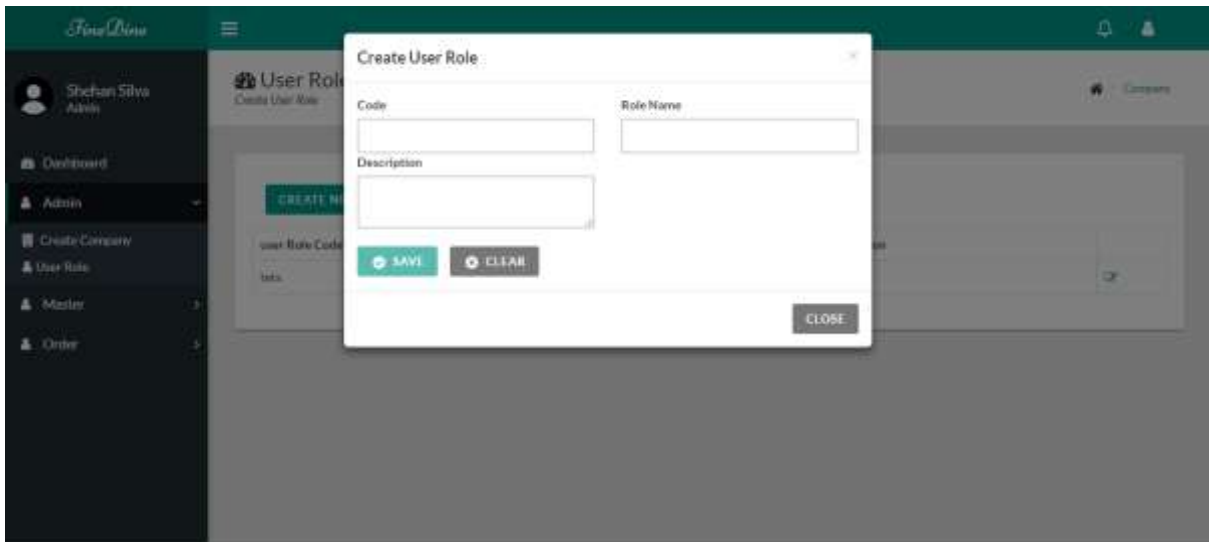
Figure 4:7: User role

Above interface use to create user role for grant user privileges.

4.4.2   Forms related to ordering process

When customer came to the restaurant he or she need to initiate order entering mobile number.

Following interface use to achieve particular purpose in mobile application.
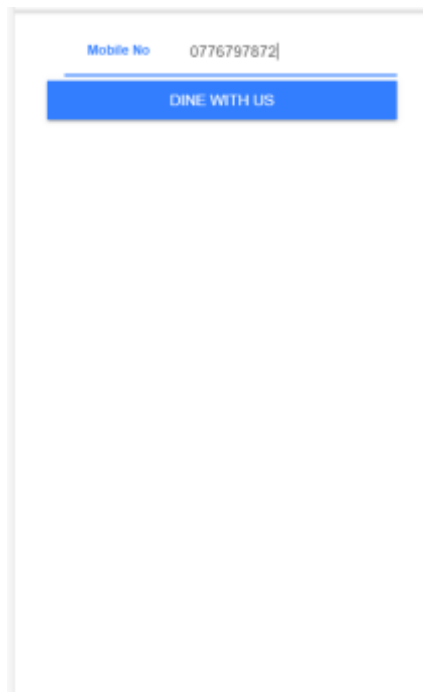
Figure 4:8 : Order initiation

After initiating customer need to select what kind of food category they need.

35
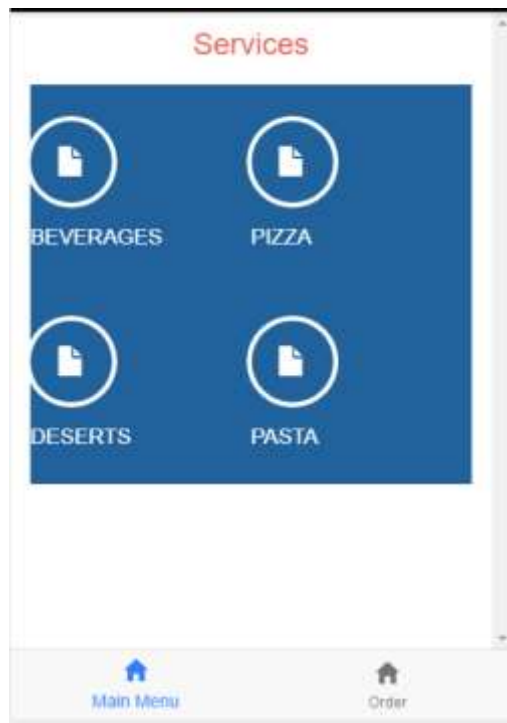
Figure 4:9 : Main menu

After selecting particular category, then displays food items belongs to selected food category.

Figure 4:10: Sub menu

After selecting food item customer need to select portion size and quantity which they want.
And also they can put special comment regarding food item
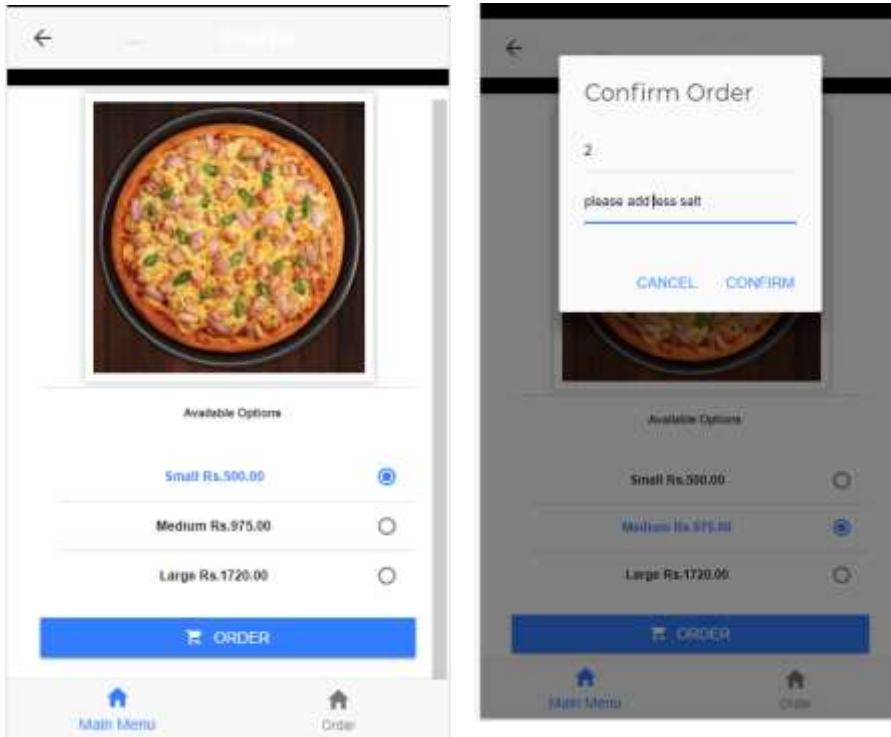
Figure 4:11: Item Selection

After that customer need to conform the order. Once they conform the order they cannot edit that.
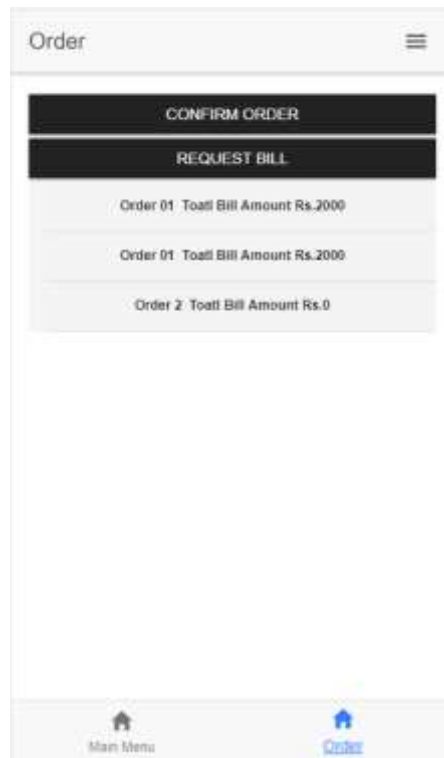
Figure 4:12: Order display

After confirmation order will send into the kitchen. So it will appears on screen in the kitchen and responsible person can take order giving estimated preparation period.
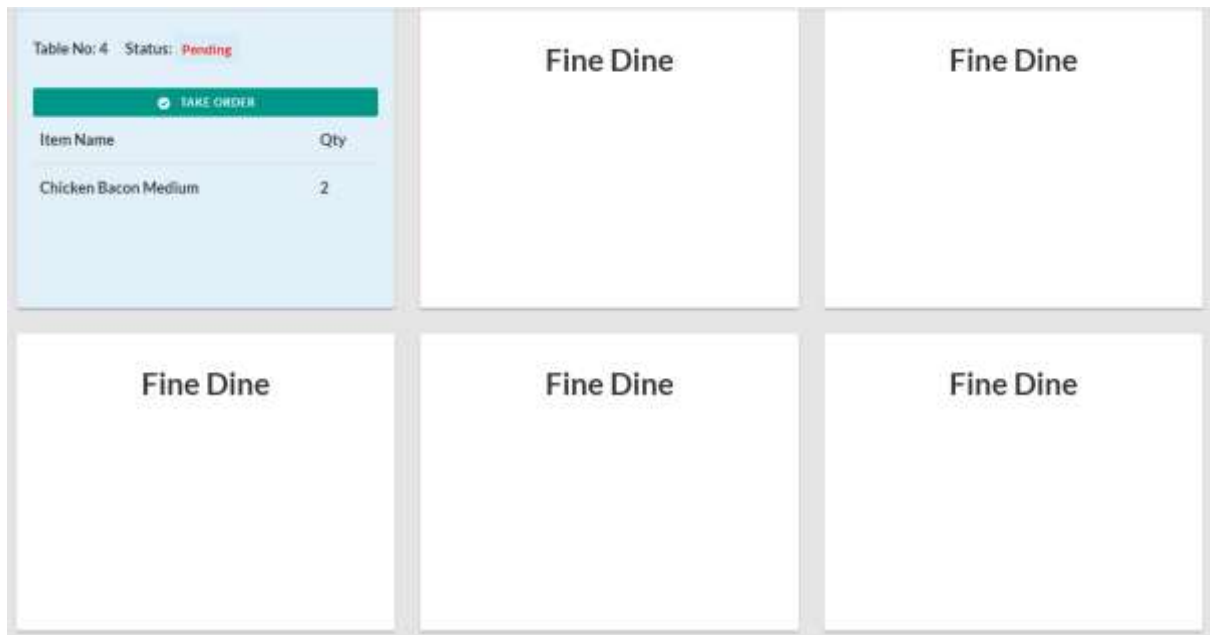
Figure 4:13 : Kitchen display
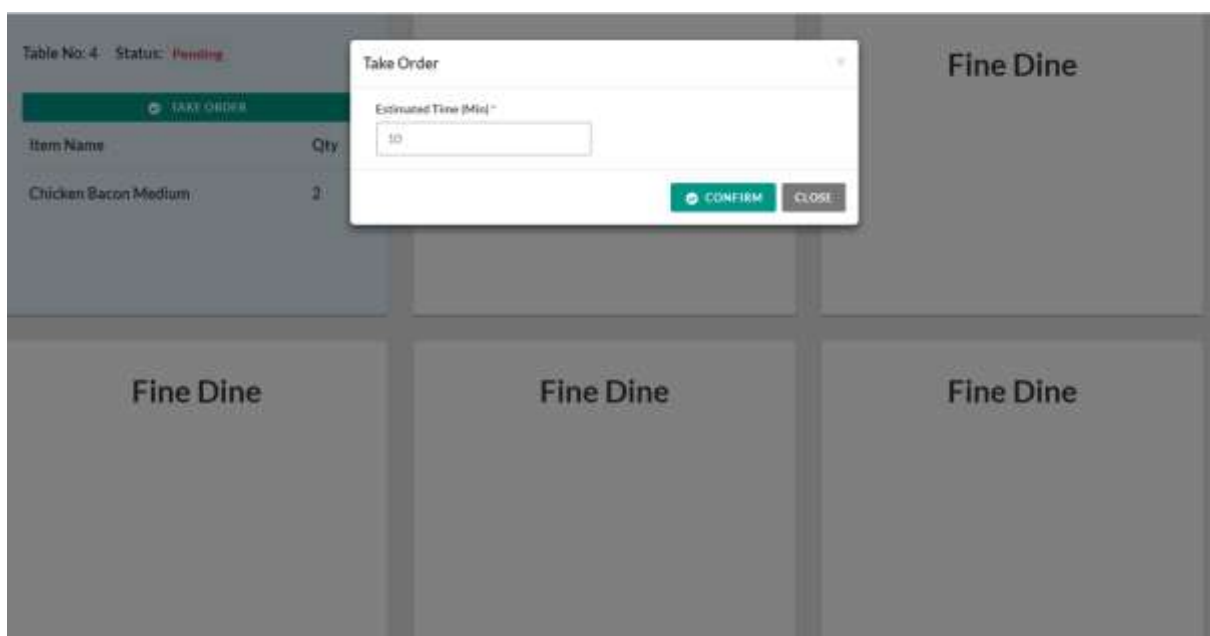
Figure 4:14: Take order

Then after preparation process kitchen staff can complete order. Once they finished conformation message will send into customer and they can collect order
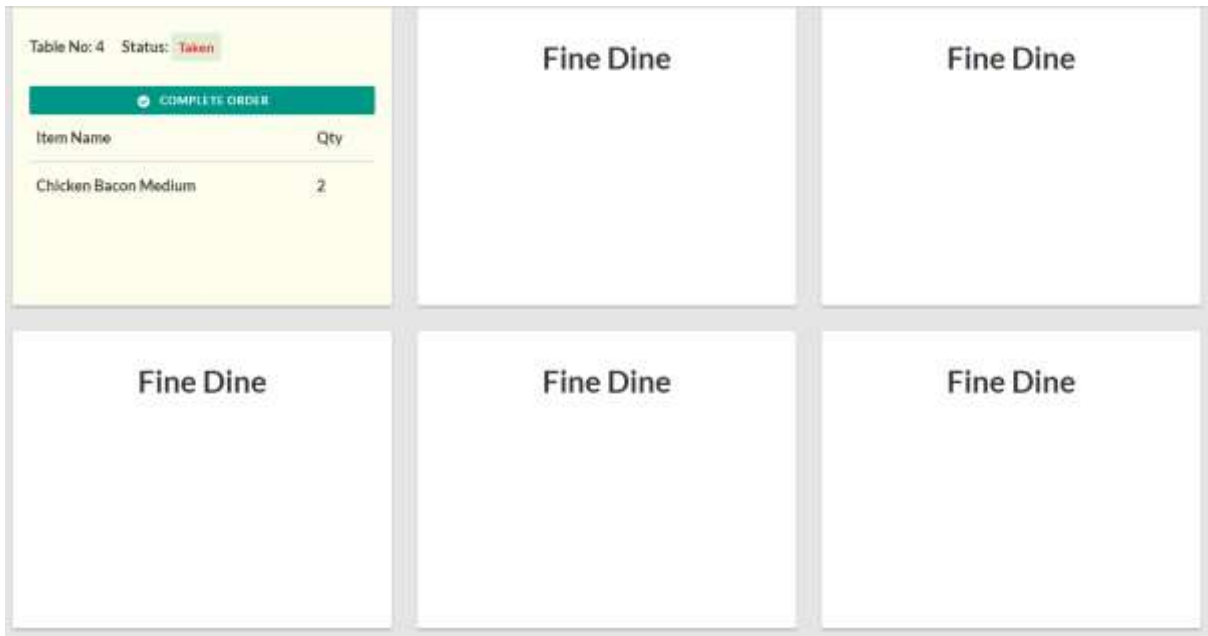
Figure 4:15 : Complete order

When making product it should be easier to use, and matching them more closely to user needs and requirements. Within next chapter will evaluate how much system will accomplish the user requirements and how much deviated with bug's free product. User Evaluation and Testing

5   User Evaluation and Testing

5.1   Testing
5.1.1   Overview
Basically Testing is the process of executing a program or system with the intent of finding software bugs, errors or other defects which may cause damage to the project Stake holders and make sure that system functionalities are tally with user functional requirements. Shortcomings can be in any Stage of the Software development cycle. These shortcomings can cause the system to malfunction or cause serious issues in fine dine. It is important to identify all these errors and fix them before handing it over to the customer.

5.1.2   Software Testing Hierarchy
As with almost any technical process, software testing has a prearranged order in which things should be done. The following is a list of software testing categories arranged in sequential order. These are the steps taken to fully test new software in ready for marketing it.

5.1.2.1   Unit testing
Unit testing is a software development process in which the smallest testable parts of an application, called units, are individually and independently scrutinized for proper operation. When developing finedine application I included test methods for each critical components. **Test Methods advantage is in future when made some code change to the existing code section directly developer can identify if there has some impact to the existing behavior from particular change.** Following image shows that sample test method which added to order management section.

```
40
41              [TestMethod]
                −references | 0 exceptions
42      ⊟       public void TestOrderMesage()
43              {
44                  int mesageCount= _orderService.GetPendingMessages().Count();
45                  Assert.AreEqual(0, mesageCount);
46              }
47
```

Figure 5:1 : Unit testing implementation

5.1.2.2   Integration testing
Integration testing done before, during and after integration of a new module into the main software package. This involves testing of each individual code module. One piece of software can contain several modules which are often created by several different programmers. It is crucial to test each module's effect on the entire program model.

5.1.2.3 System testing

System testing done by a professional testing agent on the completed software product before it is introduced to the market.

5.1.3 Testing methods which used.
5.1.3.1 Black Box testing

Black box testing is a software testing technique that focuses on the analysis of software functionality, versus internal system mechanisms. Black box testing was developed as a method of analyzing client requirements, specifications and high-level design strategies.

A black box software tester selects a set of valid and invalid input and code execution conditions and checks for valid output responses.

Black box testing is also known as functional testing or closed-box testing.

Black box testing advantages include:

- ✓ Simplicity: Facilitates testing of high-level designs and complex applications
- ✓ Conserves resources: Testers focus on software functionality.
- ✓ Test cases: Focusing on software functionality to facilitate quick test case development.
- ✓ Provides flexibility: Specific programming knowledge is not required.

Fine Dine requires knowledge of the software structure. A good testing plan will not only contain black-box testing, but also white-box approaches, and combinations of the two.

5.1.3.2 White-box testing

Contrary to black-box testing, software is viewed as a white-box, or glass-box in white-box testing, as the structure and flow of the software under test are visible to the tester. Testing plans are made according to the details of the software implementation, such as programming language, logic, and styles. Test cases are derived from the program structure. White-box testing is also called glass-box testing, logic-driven testing or design-based testing.

Test plan and the all the test cases which relevant to implementation attached to appendix B and appendix C sections. Please refer appendix section.

5.2 Usability Testing

Basically user evaluation target is how well user can learn the process and use a product achieve their goals. It also refers to how satisfied users are with that process. Focusing that manner I captured some user scenarios considering system domain.

Usability testing refers to evaluating a product or service by testing it with representative users. Typically, during a test, participants will try to complete typical tasks while observers watch,

listen and takes notes. The goal is to identify any usability problems, collect qualitative and quantitative data and determine the participant's satisfaction with the product.

Throw the usability testing my target is evaluate following criteria.

1. **Effective** - Software is useful and helps users achieve their goals accurately.
2. **Efficient** - The speed (with accuracy) with which work can be done.
3. **Engaging** - How pleasant, satisfying, or interesting an interface is to use.
4. **Error tolerant** - How well the product prevents errors and helps users recover from any errors that do occur.
5. **Easy to learn** - How well the product supports both initial orientation and deeper learning.

To evaluate those criteria I prepared questionnaires targeting following user scenarios

5.2.1 User scenarios
5.2.1.1 Scenario 01
Mr. Perera, 52, works in finance   department of MAS Holdings. Most of time in the weekends he like go out for dinner with his family. But he doesn't like wait in long queue in the restaurant and he always try to find the place with calm environment. Mr. Perera not come up with technological background and he never used smart phones.

5.2.1.2 Scenario 02
Mr. Mark Jayasuriya, 35, working as chef on Sri Lankan well know restaurant chain. Based on more than ten years his experience the busiest place in restaurant is the kitchen and it should be functioning properly without any delays or hindrance to support the customer efficiently. Main problem which he facing that the method of assigning orders to the chef. That doing by warble manner and warble communication is really messy and this cause the orders to be miss placed miss read miss order, and also this will result in two staff members preparing the same dish.

5.2.1.3 Scenario 03
Mr Palitha Wijewickrama, 50, is owner of the Chinese restaurant called zomato. He always try to improve satisfaction of his customers and like to move with new technology, but he doesn't have any technological background. One of his main concern is he wants to monitor customer wise food trends.

5.2.2   User evaluation summery

After analyzing user feedbacks (Feedback forms attached to appendix section) finally I came to following conclusions.

Criteria	Overall status
Software is useful and helps users achieve their goals accurately.	Excellent
The speed (with accuracy) with which work can be done.	Excellent
How pleasant, satisfying, or interesting an interface is to use.	Excellent
How well the product prevents errors and helps users recover from any errors that do occur.	Need to improve
How well the product supports both initial orientation and deeper learning	Need to improve

Table 5:1 : User evaluation summary

The conclusion is intended to help the reader understand why implementation documents should matter to them after they have finished reading the paper. A conclusion is not merely a summary of the main topics covered or a re-statement of your research problem, but a synthesis of key points and, if applicable, where recommend new areas for future research. Within next chapter evaluate the final evaluation of the implementation.

6 Conclusion
6.1 Introduction

The original objective of this project was the design and implementing a new restaurant management system targeting all kind of restatements. The identified problem was the most of Sri Lankan restaurants focus on the manual labor and most operations are done by human initiatively. This makes the whole business process inefficient and time consuming because the current system consumes more time to carry out its operations. So loss of time will be directly influencing the productivity of the restaurant. With focusing above mentioned problems finally I be able to build up software success solution to overcome those problems.

The Fast food and restaurant industry is an important aspect of the world economy. So there are other distinguished organizations in the markets which has adopted software's such as Waiter one and expodine. These organizations have already processes automated systems and most of them were similar systems. So by observing the initiatives of other competitors I could get a clear understanding of the functions which should be consisted within the proposed system. Also this helps to develop a better system by identifying the drawbacks of those systems. Then Project objective, Project Scope was provided. Here the study of requirement analysis had to be performed based on the actual environment of the organization to assess how those factors can be used to run core business functions of restaurant and the limitations of that study was provided.

The software requirements are description of features and functionalities of the target system. Requirements bring the anticipations of users from the software product. The requirements can be obvious or hidden, known or unknown, expected or unexpected from client's point of view. Within the project i was carried out a feasibility study and requirement Also Requirement gathering through fact gathering techniques such as Interviews, Observations, Questioners, Document revises website Visits and study of similar systems. Afterword's the gathered requirement were separated as Core requirements and Secondary requirements also the resource identifications was also done as Hardware and Software. Then Software process model which was used for the system to be developed was identified and justified with proper reasons.

Then a technical research was carried out on Asp.net core and angular 4 which were used to build the system. When consider technologies both technologies are new for the industry and I took massive exposure with those technologies. When comes to architectural side I used proper mechanisms, security features which real industry using. As example token wise authentication is the industry standard which use as security feature and here I applied this technology also.

Systems design is the process of defining elements of a system like modules, architecture, components and their interfaces and data for a system based on the specified requirements. It is the process of defining, developing and designing systems which satisfies the specific needs and requirements of a business or organization. Within the project basically design phrase carry out using functional oriented methods and Object oriented methods such as use case diagrams business activity model and entity relationship diagram etc.

6.2 Lessons learnt
While having discussion with restaurant management, they wanted to get rid of the waiters form their staff. But in a way the market build up in Sri Lanka, It seems not practical. Because we can't just let customer to go to the cashier & settle the bill. When the place is really busy, some might leave the place without paying. So when I implement automated system for an organization, have to think wisely & more practically.

When comes to my carrier now I working as software engineer and within the system implementation in different stages based on responsibilities I worked as developer, database engineer project manager, architecture and quality assurance engineer simultaneously, when individual people comes to the industry allocated to accomplish those responsibilities. Because of that this is the massive opportunity to build up my carrier.

6.3 Future Enhancements
✓ **Carrier out customer royalty programs through the system**
Within the implementation system will capture customer behavior using the customer mobile phone, so then I in the future I hope to carry out those data to carry out customer royalty programs. As example using those data we can identify who are the regular customers to restaurant, so then management can give some rewards to them.

✓ **Build of material implementation**
When considering food industry bill of material is important tool also known as the BOM or recipe. The bill of materials is a listing of the raw materials and work in progress and the quantities of each needed to manufacture a finished product. In future system I'll going to integrate this functionality.

✓ **Inventory control system implementation.**
Here most important aspect is figure out and maintain the optimum level of items in the inventory. Then it will help to provide food items continuously on demand.

6.4 Critical assessments of the project

When comparing to the similar systems finedine real time analytics feature is the one of the unique feature to the FineDine system. In other hand customer validation feature also unique feature for the Finedine system. That feature enables future restaurant e-marketing opportunities.

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