POS System Integrated with Cross-Platform for Supervision of Restaurant's

Alisha Farman[1], Hira Farman[2], Dr Saad Ahmed[3], Anees Ahmed[4]

sp20mscs0071@maju.edu.pk, hira.farman@iqra.edu.pk, saadahmed@iqra.edu.pk   anees.ahmed@iqra.edu.pk

Department of Computer Science,
Mohammad Ali Jinnah University, Iqra University

ABSTRACT:

As the Restaurant industry is growing rapidly. The demand for an effortless POS (Point Of Sale) system which can make management easy is increasing. So, the purpose of this study is to digitalise the growing industry of restaurants and its consumers by utilizing cross-platform development. Cross-platform development frameworks provide great opportunities to solve the issues of handling ubiquitous devices with minimum efforts to reduce the cost and increase the stability, accessibility of the end consumers. By availing those opportunities, an Integrated POS system with cross platform is proposed. This integrated cross-platform POS system is originally designed for a single restaurant managed by its own private cloud server. This research solves the 2 major problems. One of them is the accessibility of the system on modern devices without even writing platform-specific code with the help of cross-platform development. This included web, mobile, desktops & tablets at the same time with the same codebase. Second one is handling data consistency with ubiquitous devices with the help of cloud infrastructure to make data safe and consistent more than ever. In the Development of this system Dart will be used as the primary programming language for cross-platform development. On the Cloud server system apache will be used as the web server and PHP as server side language. System will be using MySQL as the database server.

Keywords:
Ubiquitous devices, pervasive devices,Pos, Cross-platform, Restaurant management, integrated system

1. INTRODUCTION

Technology is evolving so rapidly that gadgets &hand-held devices are increasing day by day. People are now more familiar with their tablets & cell phones than desktops. This is also an advantage for small-scale businesses to use technology more easily and in a more accessible manner rather than setting up the whole system for it. Technology is empowering these businesses and to reach a global market ubiquitous devices with applications are used that make things more manageable. Considering only restaurants which is one of the vastest business categories in the market. As this business grows it will get more difficult to manage without a proper management/sales system which can make the ordering process for customers as well as restaurants easier.

Restaurants rely on their desktop systems for digitizing their processes but the major issue is that desktops cannot be moved very easily from one place to another. Data protection in desktop systems is another issue upon damage. Restaurant owners/managers are bound to the desktop unit even for a single operation e.g. Reporting/Sales check. Customers are also bound to use app/web ordering when they are not dining in. These issues are very common & yet waiting to be solved. Most Restaurants are operating in a traditional way with very few of them with POS systems on desktops. Recently, a short introduction to the integrated restaurant service using the system has been provided [1].

A POS system integrated with Cross-platform is the solution to primarily focus on making things more accessible with the help of state-of-the-art technologies from which we can run the system not only on desktops but also on ubiquitous devices. This makes the system access to the next level since there are no boundaries on devices. This will not only improve the restaurant's workflow but also gives more sales by making more accessible solutions for customers too. This cross-platform mechanism is also attached to the kitchen for faster deliveries with minimum human errors.

Integrating POS in cross-platform increases the accessibility for small as well as large scale businesses on ubiquitous devices at the same time. Restaurant managers/owners can use the POS system anywhere. This system consumes less electricity. This Integrated Pos system is connected with the Cloud. A cloud-based data sync process for consistency will be one of the benefits. Online solutions can be easily integrated now since the system is on the cloud. The whole system will be accessible for any ubiquitous device like a tablet,

Smartphone, web app, etc. This makes things manageable and synchronized and makes data consistent.

The POS integrated system with cross-platform is also beneficial for Customers; they will have all ease of access. In traditional ways, customers have to call a restaurant or in best cases search for the restaurant web URL to place an order. Now for the best User

Experience no matter which ubiquitous device is there, the system can be accessed flawlessly. This makes instant access to restaurants. In addition, this solution provides automation from the user's hand to the Restaurant kitchen so the order will be digitalized to the KDS system as well as POS. This makes fewer human errors as well as fastens the order preparation time.

2. RELATED WORK

In [1], the author efficiently organizes and manipulates food parcel details and payment in the restaurants by using a POS-system that is integrated with several services for restaurant management. This system can enhance service efficiency with a cost-effective restaurant system.

In [2], A Digital Ordering system integrated with a Kitchen Order ticket, a billing system is proposed for restaurants to give cost-efficient opportunities from dining, payment, ordering and feedback by using the android application for Tablet PCs. JAVA Android is used in the front-end and MySQL database is used in backend. In[3], the Authors proposed a Restaurant Automation Management System by using wireless networking protocol which targeted automation and remote-control apps technology. They used the proposed system "Arduino" Uno Atmega which is 328P family-based. Order is placed by the customer and will be wirelessly transmitted to the monitor inside the kitchen using ABee antennas. After the order is prepared by the chef it will be placed on the conveyor belt controlled by Arduino which takes the food to the customer's table. In the end, a bill will be automatically generated.

In [4], in this system the author replaces the older traditional systems like manual working which is time effective, and to reduce human error he proposed the idea. By using this ordering system, the order placing time has reduced. In the restaurant, the customers do not need to wait to be served while eating. This system will help to know the estimated preparation time of the food and allow the customers to know the status of their order.

In [5], the author presents "Rheem, a general-purpose cross-platform data processing system" that disconnects applications from the underlying platforms. They use different real-world apps with Rheem; they show the method of data processing of cross-platform can accelerate performance by more than one order of magnitude compared to single-platform data processing.

In [6], the Author Introduced a Mobile app for communicating with the POS system. The bar or the restaurant has been automated by app and placing orders and bills will be in real-time.

In [7], there is a management system, comprising a hub, a set of clients, and a point of sale system, the management system operable to be controlled by management tool software which provides a user interface. The management system used as a table management system in restaurants. In [8], they use the technique of automatically generating an order in the POS system with the help of a smart Phone/tablet etc of a customer and a POS system associated with a restaurant chain. Which automatically generates an order in the POS system, and receives customers;s information from the remote database, and sends at least a portion of that information to the POS system as identification of order at the restaurant.

In [9], they automate manual restaurant operation into an order-based system. The system interfaces with disparate devices and systems to provide order-based monitoring and control of operations within an establishment. To decrease employee and operations costs, restaurants are increasingly employing software suites and automation in order to streamline and improve operations. Such systems gather information about orders, coordinate with available inventory, and provide guidance to front-end employees that interact with customers and back-end employees that manage inventory and prepare food. Restaurants are also increasingly automating processes of ordering and food preparation, for example, with touchscreen and application interfaces for ordering and robotics and automated kitchen equipment taking over repeatable or dangerous tasks.

In [10], a system and method for online management of restaurant orders comprise a server computer for storing data and sending the order from the POS module to a POS database server and sending a status request from the middleware module to a first web user interface. Additionally, this system allows a customer to fax an order directly to the waiter office then the waiter office processed the order

In [11], Author disclosed a WWW-based POS for both consumer self-service ordering and billing functions. They used a network-connected device which is connected online with the WWW-based POS of a web server, and a browser is provided as an interface of both functions of the cashier ordering and billing interface and the consumer self-service ordering and billing interface at the same time and can switch from one to another according to actual requirements and conditions.

In [12], a mobile app-based ordering system order can be placed with integrated Restoration automation can be done by GPS which receives data from the mobile devices without POS. A user associated with the restaurant uses the mobile restaurant ordering system to define the predetermined geographic region. The server may be configured to dynamically alter the predefined geographic region associated with the restaurant based on certain associated factors with the restaurant, the order, and/or the customer

In [14], the nourishment industry or the eatery commerce has continuously been one the foremost beneficial and developing businesses.

F#	Name	Description of Features
F1	POS integration	POS integration is the corresponding connection between your POS software and your restaurant accounting and performance accounting. Integrated, your operating platform can download detailed information directly from your POS in real-time.
F2	MySQL	MySQL is an open-source relational management system. It is a combination of columns and rows that also integrate the different applications.
F3	Flutter	It is an open-source UI development tool developed by Google. Used for upgrading Android, iOS, Linux, Mac, Windows, Google Fuchsia, and web applications from a single code case.
F4	Database	A database is a collection of data organized, stored, and accessed electronically from a computer. When information becomes more complex it is often done using formal design and modeling methods.
F5	Mobile Computing	Mobile Computing is a technology that allows the transfer of data, voice, and video via a computer or any other wireless device that is not allowed to be connected to a fixed physical link.
F6	Hub	Standard device for network connections. Hubs act as a central connection to all network equipment and carry a type of data known as frames.
F7	Cloud Computing	the practice of using a network of remotely hosted servers on the Internet to store, manage, and process data, rather than a local server or personal computer.
F8	Web Server	It is a computer program that shares web-pages as requested. The primary purpose of a web server is to store, process, and deliver web pages to users. This connection is made using the Hypertext Transfer Protocol (HTTP).

As innovation is advancing day by day and to maintain itself within the nourishment industry. The eatery must come up with modern and inventive administrations which they can give to the clients. Widespread has made a major effect on

the commerce of the eatery industry in 2020. It how innovation can offerassistance in food requesting, whereas taking care of the COVID-19 widespread rules. The reason of this paper is to analyze the effect of COVID-19 within the food industry and recommend strategies that would offer assistance restaurants to adjust to challenges that begin from COVID-19. One of the ways would be to computerize the food ordering prepare. This term paper based on "Contactless food requesting system"

[13] In this paper, we discuss the design and implementation of a customizable wireless food ordering system with real-time customer feedback for a restaurant (CWOS-RTF). The CWOS-RTF enables restaurant owners to setup the system in wireless environment and update menu presentations easily. Smart phone has been integrated in the CWOS-RTF implementation to facilitate real-time communication between restaurant owners and customers. A preliminary testing suggests that
The CWOS-RTF has the potential to eliminate the limitations of existing food ordering systems
.

[15]"Online Restaurant Administration Framework" may be a web application. This framework is created to mechanize day to day activity of an eatery. Eatery may be a kind of trade that serves individuals all over world with ready-made nourishment. This framework is created to supply service facility to eatery conjointly to the customer.

An Eatery Administration System (RMS) may be a sort of Point-of-Sale (POS) computer program particularly outlined for eateries, bars, nourishment trucks and others in the food benefit industry. Not at all like a POS system and RMS envelops all back-end needs, such as stock to staff management. Too e-Restaurant may be a eatery reservation framework planned to supplant the write & paper approach to reservation administration. The computer program has been construct from the ground-up to be as simple to utilize as conceivable as well as extremely capable and exceedingly customizable to suit any eatery environment.

[16] As a solution, the extend group has actualized a versatile application which is capable of capturing a picture of a nourishment and recognize it and degree the weight. With the assembled information, the executed framework contains an intelligent agent giving recommendations of food for mulas with remaining foods and a few extra highlights such as direction to the client to plan any kind of nourishment with the assistance of

an intelligently Chatbot as well as the user has been coordinated to induce sound suppers by considering the past dinner plans and factual report investigation. As the comes about the actualized formula era calculation of nostalgic examination has gotten 76% precision and inaddition the group has gotten more preci se special procedure for weight estimation than the right now accessible calibration procedures.

[17]The system is executed to decrease the manual work and upgrades the exactness of work in a restaurant. This framework oversees and keeps up the record of clients and their arrange online. This Android App has been made in a user neighborly interface.so the client can and erase the nourishment things effortlessly. The menu card of diverse restaurant consists of different nourishment assortments accessible within the eatery. Through the put requesting menu ,the client can essentially click and arrange the nourishment. The informing module tells the provider to supply the specific nourishment. Moreover following module track the order. The charging framework plans the charge agreeing to the conveyed nourishment.
This framework completely decreases the unnecessary time. Each arrange is related with an person situate at the table, and orders are built one customer at a time, similar to on paper, but with more noteworthy exactness. Things can too effectively be shared by the entire table, moved or altered, and famous and the cost can be calculated in genuine time

TABLE I: Features summary

III: Sources and Features

S#	Source Name
S1	[1] "Integrated Restaurant Service Using POS System"
S2	[2] "Digital ordering system for restaurant using Android"
S3	[3] "Automated restaurant management system"
S4	[4] "Restaurant ordering system"
S5	[5] "RHEEM: Enabling Cross-Platform Data Processing: May the Big Data Be with You!"
S6	[6] "Bar or restaurant check-in and payment systems and methods of their operation"
S7	[7] "Restaurant service and management system"
S8	[8] "System and method for a wireless mobile device interface integrated with a restaurant point of sale system and with a cloud-accessible data center for querying a database of customer information"
S9	[9] "Integrated front-of-house and back-of-house restaurant automation system"
S10	[10] "System and method for online management of restaurant orders"
S11	[11] "Www-based pos with both consumer self-service ordering and billing functions"
S12	[12] "Mobile restaurant ordering system"

TABLE

F\S#	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	Our Work
Fe1	P	P	P	A	A	P	P	P	P	P	P	A	P
Fe2	A	P	A	A	A	A	A	A	A	A	A	A	P
Fe3	A	A	A	A	A	A	A	A	A	A	A	A	P
Fe4	A	P	A	A	A	A	A	A	A	P	A	A	P
Fe5	A	A	A	P	A	P	A	A	A	A	A	P	P
Fe6	A	A	A	A	A	A	P	A	A	A	A	A	A
Fe7	A	A	A	A	A	A	A	P	P	A	A	A	P
Fe8	A	P	A	A	A	A	A	A	A	P	A	A	A
Fe9	A	A	A	A	A	A	A	A	A	A	A	P	A
Fe10	A	P	A	A	A	A	A	A	A	A	A	A	P
Fe11	A	P	A	A	A	A	A	A	A	A	A	A	P
Fe12	A	A	A	A	P	A	A	A	A	A	A	A	P

3. METHODOLOGY

A. Modules

Integrated system consists of two Modules.

accounts as well as view the history of place orders.

This module will handle items which are added

3.1 Customer Facing Apps

This module provides customers a user interface for selecting menu items, adding them to their order & placing orders. This module will consist of ubiquitous devices. It also provides access to customers to manage their

These are some of the main features in Customer-Facing Apps

Order

to the basket for placing an order as well as the   totals & taxes.

This module will take orders to the server along contain online payment integration.

TABLE II: Source Table

- **Account Login/Register**

This will create new accounts for customers as well as login the existing one's before placing an order to maintain the customers database.

- **Account Settings & Order History**

This will allow users to change their account settings & view orders placed in the past.

3.2 Restaurant Facing System

This module will be used by restaurants to manage orders as well as sales. This module will also contain a POS system to add & view new orders. This module will also contain a Kitchen display system. All of these modules will consist of ubiquitous devices. This module

mainly contains following features

- **POS for adding new Order as well as viewing online orders.**

POS provides a full sales interface for placing managing orders. This will consist of an items panel to add new items to order for walk-in or dine-in customers. as well as a real time calculation system to make an order on the go. ● **Sales for viewing sales reports**

This feature makes sales visible to restaurant managers & owners. It will also export per month/year sales for better analytics & accounts management.

- **Menu Management**

This feature allows users to edit/add new items to the menu as well as make restaurant owners/managers change prices and discounts on them.

- **Kitchen Display System (KDS)**

This feature displays orders in the kitchen confirmed from POS. In Kitchen chefs will directly view which order to prepare along with its items.

- **In-House waiter accounts**

This feature makes waiters access the menu on their devices along with taking orders for dine-in customers. These orders will be directly forwarded to POS and KDS.

with the required user information like Address etc. This will also

- **Inventory for stock**

This module will manage the stock for menu items & automatically prevent customers from placing the order of out-of-stock items. This will also help getting new stock in a systematic manner.

B. Technical Stack

- **Cross-Platform**

Since the integrated system consists of cross-platform technology, to support our needs the best framework is Flutter. It was developed recently by Google & is pretty famous for its capabilities of developing apps for ubiquitous devices. This framework will handle all the platforms with a single codebase.

- **Cloud Server**

Cloud servers are the heart of our system. It contains all the business logics and Databases along with an HTTP server for hosting data. This will contain Apache for HTTP requests resolution & MySQL for data storage.

C. System Flow

The flow of the integrated system as mentioned in fig 1. is started by creating a menu in the restaurant system. Restaurants will have to set up their menu items in the system for customers and for their own track. This menu data will go to the cloud server. When a user reaches the cross-platform system with their devices, they will see the menu uploaded by the restaurant using a cloud server. Menu items can be added to order and the order of the places will get on the cloud server. The server will now sync the data to the restaurant view. The restaurant manager/owner can process this order with phone call confirmation or can directly update the status to confirm. After the status update, KDS will receive this order & the chef starts preparing the order. This order status will now automatically displayed to customers via the cloud server that is under preparation. Then the restaurant will dispatch the order to delivery With the printed bill using POS.
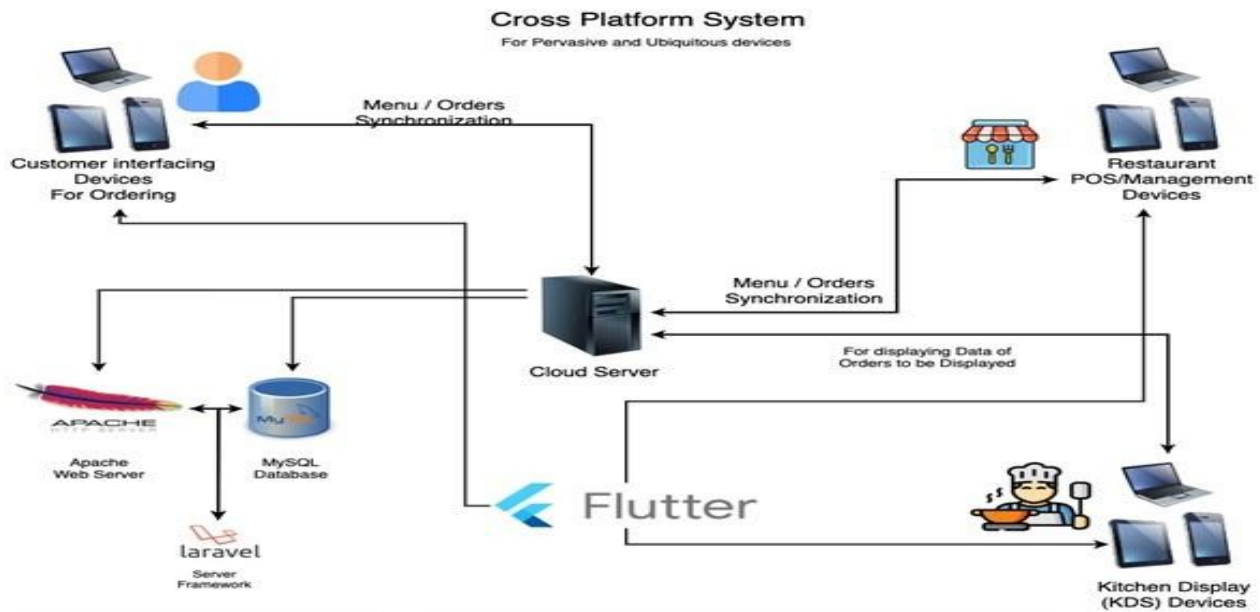
Fig. 1: System Flow Diagram

D. Setup Requirements for integrating POS with Cross-Platform

Software Requirements		Hardware Requirements:
		● **Min core i5 Processor** ● **Min 4GB Ram** ● **Color Display Monitor** ● **Internet modem**
Programming languages	● **Dart** ● **PHP** ● **JS**	
Frameworks	● **Flutter** ● **Laravel**	
Operating System	● **Windows / MacOS / Linux**	
IDE	● **Android Studio** ● **PHPStorm**	

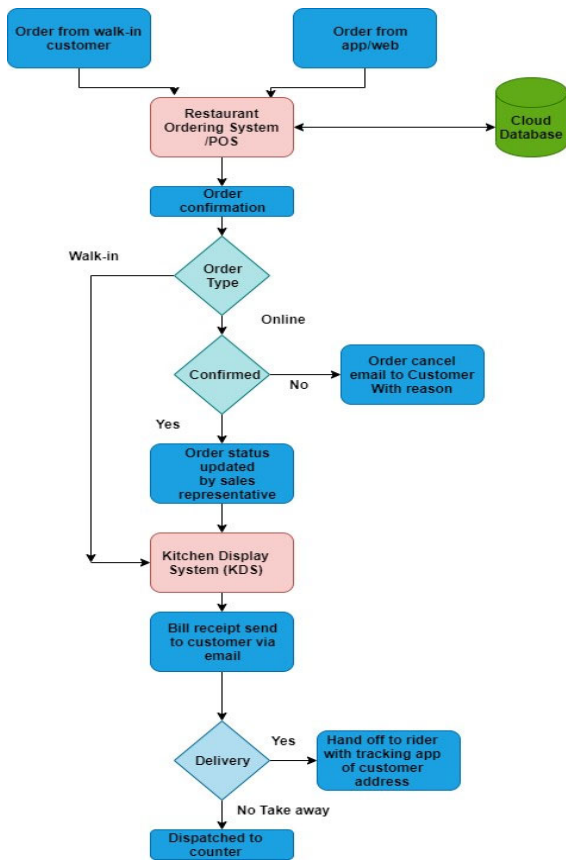TABLE IV: Requirements Specifications

Fig. 2: System Flow Chart

E. Flow Chart

In Fig 2 There are two entry points to start the flow. One entry point is for walk-in customers, in this customers will directly walk-in to the restaurant and order the items which will be entered into the POST system by the receptionist. The other entry point for online orders and it's automated. This starts with the ordering page which allows users to place an order via selecting items and adding them into cart. After placing the order, it goes to POS which is accessible by Restaurant Admin by cloud server. The order will fall into the manual confirmation by restaurant admins. the order is confirmed then it will be forwarded to KDS. After preparing the order it will be notified by KDS that it's prepared and then the integrated POS system will show this update. If the order is for delivery it will be forwarded to the rider, otherwise for takeaway, it will be taken by a customer from the restaurant. All these transactions will be maintained on cloud for consistent data across devices.

F. System Evaluation

In this section, the detailed features of the system are not discussed, but instead take a bird's eye look at the same.

- ### Performance
System will be high performance since its user-end apps are based on flutter which runs on C++ engine to UI render faster than ever. On the cloud, Laravel and apache are optimizing MySQL to handle data more efficiently.

- ### Cloud Storage
Cloud storage is used to store data on centralised database to maintain data consistency across devices. This architecture also helps secure data from damage or being tempered in case of damage to devices.

- ### User friendly
The system is cross-platform this makes it more user friendly according to preference whether its a desktop or a mobile device. System will also be designed the same for all types of devices. It makes it more user friendly and accessible.

- ### Secure
On devices, security is maintained by the Flutter framework which makes code signed at the time of release compilation. On the server, the system will use https self-signed certificates to ensure data security which will travel through API's. On API's, Laravel Framework will provide multiple security layers with header authorization and data encryption.

4. CONCLUSION:

Integration of POS in Cross-Platform domain For Restaurant Management revolutionaries the industry to a whole new world of mobile gadgets empowering not only the restaurants but the customers to use POS & Ordering systems in ubiquitous devices. This Integrated POS system provides the edge of mobility with cross-platform frameworks. In this era, every Industry is Demanding mobility with their systems so now with this approach, they can achieve a whole new way of how systems can be accessed. BY this system the management of orders will be easier. The integrated system is user-friendly and also guarantees good-quality customer satisfaction service. Customers can now order from any ubiquitous device from anywhere. Combining this architecture with cloud infrastructure makes it more scalable and centralized to keep sync across all platforms.This will revolutionize the industry.

One of the weaknesses in this proposed integrated POS system is that it has to be deployed separately for each restaurant. This problem can be solved by implementing the SAAS model. By using SAAS, virtual deployment can be achieved connected to a central database where all restaurant data will be combined. In this way, a Subscription based model can be used for scaling the revenue of SAAS based systems.

Another idea for the future is to implement marketing strategies for restaurants by this platform which is powered by SAAS. In this way the system can create a directory/Marketplace for restaurants enrolled via SAAS model and use SEO (Search Engine Optimisation) for making their restaurants appear in search engines automatically. This technique will affect the SAAS product as well as its clients to scale further.

REFERENCES:

[1]. Shreeja T H, Vigneshwar S,"Integrated Restaurant Service Using POS System",International Journal of Emerging Technology and Innovative Engineering Volume 5, Issue 10, October 2019, (ISSN: 2394 – 6598)

[2]. Ashutosh Bhargave, Niranjan Jadhav, Apurva Joshi, Prachi Oke, Prof. Mr. S. R Lahane, "Digital ordering system for restaurant using Android",International Journal of Scientific and Research Publications, Volume 3, Issue 4, April 2013 1 ISSN 2250-3153

[3]. Aman Jain, Snehal Chauhan, Anish Hirlekar , Suraj Sarange,"Automated restaurant management system", International Journal of Innovative Research in electrical, electronics, instrumentation and control engineering , Vol. 4, Issue 5, May 2016

[4]. Wong, Siew Jiuan "Restaurant ordering system. Final Year Project, UTAR, 2009.

[5]. Divy Agrawal, Sanjay Chawla, Bertty Contreras-Rojas, Ahmed Elmagarmid, Yasser Idris, Zoi Kaoudi, Sebastian Kruse, Ji Lucas, Essam Mansour, Mourad Ouzzani, Paolo Papotti, Jorge-Arnulfo Quiané-Ruiz, Nan Tang, Saravanan Thirumuruganathan, and Anis Troudi. 2018. RHEEM: enabling cross-platform data processing: may the big data be with you! Proc.VLDB Endow. 11, 11 (July 2018), 1414–1427.

[6] Spirin, Gennady; McGregor, Jeffrey,"Bar or restaurant check-in and payment systems and methods of their operation" U.S. Patent 8498900B1, issued 2012.

[7] Potter, Daniel and Hunwick, Noel and Wentworth-Shaw, Nicholas, "Restaurant service and management system" U.S. Patent

20150178864A1, issued 2015.

[8] Garrett, James M; Medynskiy, Yevgeniy, "System and method for a wireless mobile device interface integrated with a restaurant point of sale system and with a cloud-accessible data center for querying a database of customer information" U.S. Patent 10783595B2, issued 2020.

[9] Rao, Krishna; Lange, Shawn; Tanaka, Samuel; Lent, Cory; Norman, John Paul; Hempy, Hogan; Bowdach, Cory; Ishiguro, Peter, "Integrated front-of-house and back-of-house restaurant automation system" U.S. Patent 20200249660A1, issued 2020.

[10] Shimoff, Jared R; Easley, John C; Moothart, Gabriel T; Birchem, Mark A; Casci, Brandon, "System and method for online management of restaurant orders" U.S. Patent 8650095B1, issued 2014.

[11] Cheng, Kuang Hung, "Www-based pos with both consumer self-service ordering and billing functions" U.S. Patent 20200151693A1, issued 2020.

[12] Garrett, James M and Connelly, Ryan, "Mobile restaurant ordering system" U.S. Patent 10109026B2, issued 2018.

[13] Yawen Li; Xiangyun Wang; Xue Wang ,"E-commerce on-line catering reserving and ordering system based on mobile intelligent terminal", IEEE international conference 2011

[14] Ram Murti Rawat; Ashish Rana; Akshit Beck ,"AI based Impact of COVID 19 on food industry and technological approach to mitigate",IEEE 5th international conference ,2021

[15] Prof. Shezad Shaikh , Kajal Choudhary , Shivani Bhavsar , Sharmin Mansuri, Ankita Saner ,"Implementation of Smart Restaurant Using Smart Phone Application", International Advanced Research Journal in Science, Engineering and Technology Vol. 7, Issue 4, April 2020

[16] "Zero Food Waste: Food wastage sustaining mobile application", M.D.C.J Gunawardane,H.A.N Pushpakumara ,E.N.M.R.L Navarathne,Shashika Lokuliyana,K.T.I. Kelaniyage,Narmadha Gamage

[17] Prof. N. M.Yawale#1, Prof. N. V. Pardakhe#2 , Prof. M. A. Deshmukh#3, Prof. N. A.Deshmukh# "A Review Paper on Online Restaurant Management System", iaetsd journal for advanced research in applied sciences volume 4, issue 7, dec/2017 issn no: 2394-8442