

# Click & Eat Application

## Research Document



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Bachelor Of Science (Honours) Software Development



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## Declaration

I declare that this research document titled “Click & Eat” has been written by me under the supervision of Dr. Christophe Meudec.

This work was not presented in any previous research for the award of bachelor degree to the best of my knowledge.

The work is entirely mine and I accept the full responsibility for any errors that might be found in the work, while the reference to publish materials have been duly acknowledged.

I have provided a complete table of reference of all works and sources used in the preparation of this document.

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## **Abstract**

The food industry is a complex and major industry in the world. As the name suggests, it supplies food to be consumed by people in the world. Almost everyone depends on the food industry except farmers, who grow and produce their food needs.

All the restaurants, hotels and other food suppliers come under this food industry. To grow their company, each food supplier has their own marketing strategies. There are many problems faced by each food supplier, especially due to the highly competitive nature of the market. (ScienceDirect, 2016)

Nowadays, COVID-19 has caused major disruptions to the food industry.

This project describes an approach to help restaurants and hotels in their ability to offer customers the experience of dining out with less interaction, due to the pandemic restrictions and everyone's safety.

This approach aims to increase efficiency and accuracy for restaurants by saving time, eliminating human errors, obtaining client feedback and most significantly, in pandemic times, encourage customers to eat out as the interaction with the employees will be reduced.

This document will illustrate how technology can help in times of a pandemic by simplifying the ordering and payment of the meals for both customers and the restaurant.

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# 1. Introduction

Technological innovation has transformed our world and everyday lives. Technology has created outstanding devices and assets, giving us easy access to information and services. Computers are progressively faster, more convenient, and more powerful than at any time in history. With all these revolutions, technology has made our lives simpler, quicker and better (AgingInPlace, 2016).

Technology has started its journey in every field of our lives, however, in some areas like hospitality or the food serving industries such as hotels and restaurants, the normal pen-and-paper methods are still followed for receiving orders, which is a waste of significant time for both the waiter and the customer.

Various efforts were made to bring technology into the field of hospitality. Point of Sale (POS) systems and different computer-based techniques tried to boost the service with the use of technology, however, problems like wastage of client time and service efficiency appeared (POSist, 2016).

This project introduces, details, analyzes and discusses what needs to be researched for developing a new product which supports customers and restaurants to increase efficiency and accuracy of the service, saving time, eliminating human errors, and most importantly reduce the physical contact between the customers and the staff for a safer dining experience.



## 2. Research Method

This research will apply the following strategies, processes and techniques for collecting information, data and evidence which will help to successfully reach the desired objective, the development of the proposed project.

- Restaurant industry research
- Technology in the restaurant industry
- Marketing Analysis and similar applications
- The impact of COVID-19 on the restaurant industry research

Research on the technologies, languages and platforms to be used for completing the proposed project:

- Programming languages
- Data storage technologies
- Cloud services
- Platform environment
- Algorithms

Obtain the required information using:

- Internet Resources
- Books
- Questioners
- Interviews
- Own experience

The information is written into a report:

- Periodic discussion and feedback request from the supervisor
- Information accumulated into reports
- Review report and submission

### 3. Motivation

#### 3.1 Pandemic and the Restaurant Industry

The Coronavirus pandemic impacted many aspects of the global economy, and the restaurant industry is no exception, facing the most significant challenge to date. Never before have so many restaurants been forced to close, or even worse, some may remain so indefinitely.

As conditions are changing daily, it is difficult to predict the future circumstances faced by businesses, resulting in confusion and uncertainty industry-wide.

Eating out in times of a pandemic comes with a high-risk as people can't always wear a mask and maintain social distancing. From February 24 to October 24, Figure 1 shows the frequent shift in seated restaurants due to the coronavirus pandemic around the world. 14, 2020 (Statista, 2020).

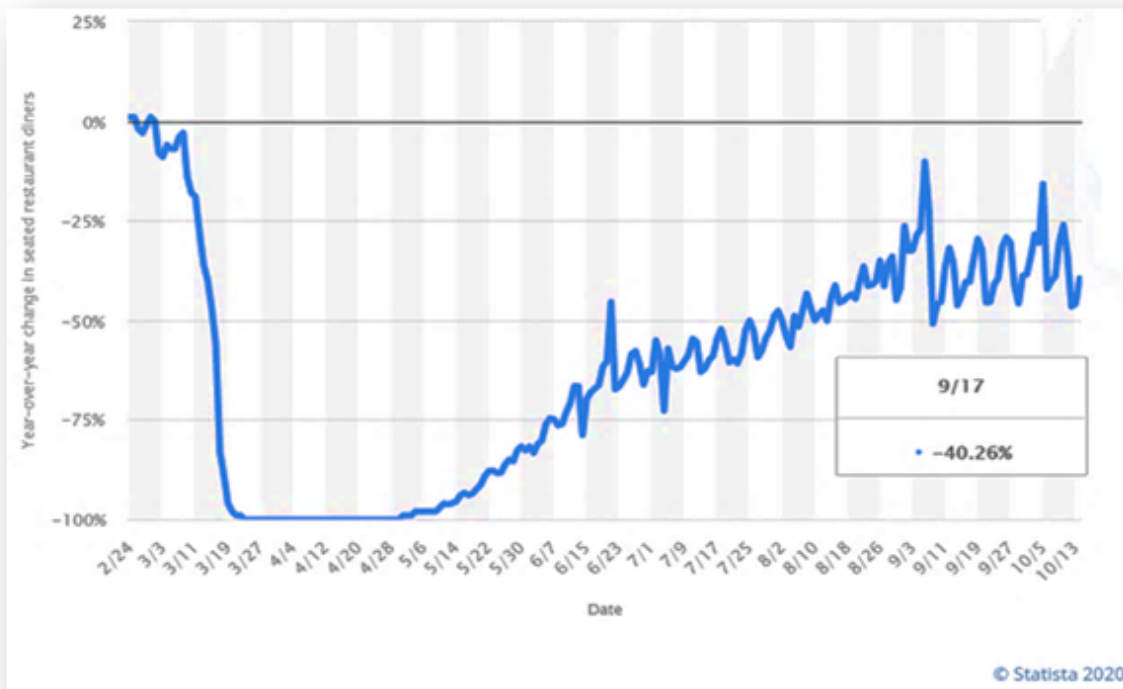


Figure 1 - Statista - Daily seated diners in Restaurants

Source: Statista [Online]

<https://www.statista.com/statistics/1103928/coronavirus-restaurant-visitation-impact/>

Being aware of the difficult situation the restaurant industry is facing and having involvement within this field, the inspiration behind this project came this summer, while at work and seeing customers worried about the COVID-19 social distancing and interaction with the staff, and furthermore not seeing them coming back, resulting in a loss for the business.

Figure 2 shows the decline in sales for restaurants, pubs and bars in the United Kingdom in March 2020 when the Coronavirus started to spread globally.

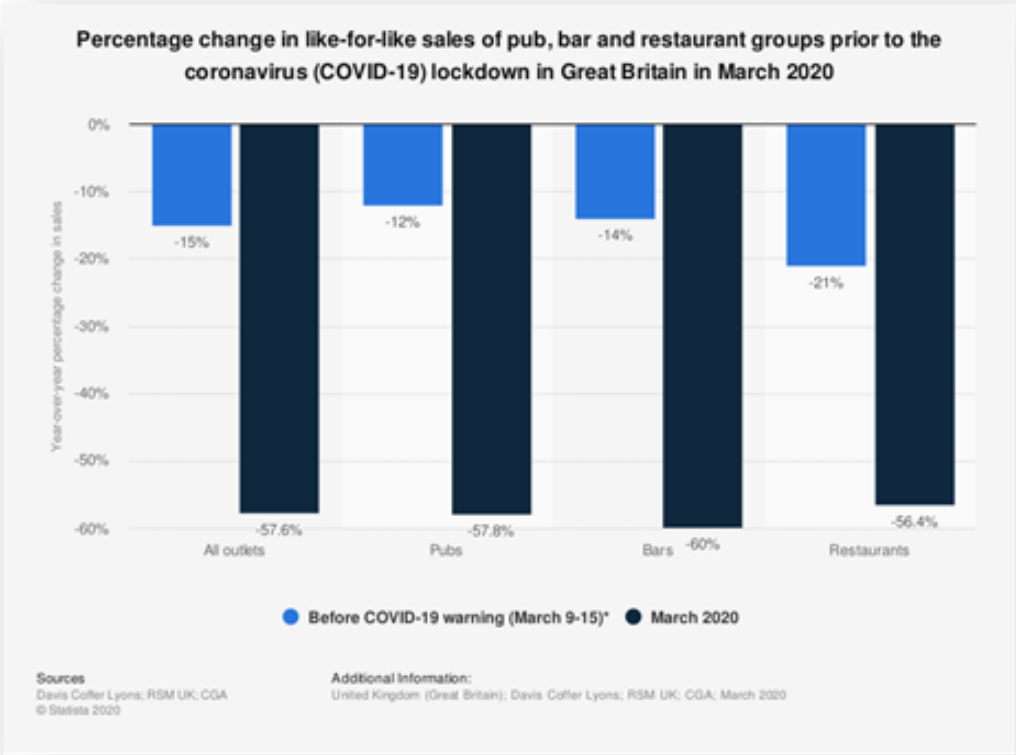


Figure 2 - Decline in pub, bar and restaurant sales due to COVID-19 in the UK 2020  
 Source: Statista[online]

<https://www.statista.com/statistics/1105174/uk-pub-and-restaurant-sales-fall-due-to-covid-19/>

The proposed project will reduce social interaction in restaurants during the Coronavirus pandemic by simplifying the ordering and payment of meals and offering services with less interaction between the customers and the staff.

## **3.2 Technology within the Restaurant Industry**

The usage of technology aids our lives in becoming more comfortable, convenient, and as a result, has become an essential in almost every field. However, technology in restaurants hasn't yet matured and reached mainstream use.

After many years restaurants still follow the antiquated process of pen-and-paper in taking orders. This system is ordinary, slow, requires more workforce, is liable to human errors and often leads to dissatisfaction for the customers and frustration for the waiters. But most of the restaurants nowadays are using a POS system that is specially designed to help run the business efficiently and to make the job of staff significantly easier.

### **3.2.1 Pen-and-paper, the traditional system**

This is the most used system in restaurants today. In this model, the waiter comes to the customer's table and presents to them the menu. They wait with a notebook and a pen to take the customer's order. The waiter writes down the order of the customer in their notebook, and the order is sent to the kitchen.

This is a simple process, but since it is an entirely manual system, there is the possibility of human errors such as missing some items when the order is taken or the paper of the notebook could get damaged, lost or mishandled.

The menu is also on stiff paper, meaning that every time the menu is updated, it must be reprinted. It is a time-consuming task and also leads to great wastage of paper. In simple words, these paper-based menus lack the ability to be updated dynamically.

### **3.2.2 Personal Digital Assistant (PDAs) system**

The Personal Digital Assistant-based system, which is a wireless interface that is easy to use and portable, is one of several upgrades to the food ordering process.

This food ordering system allows the waiter or the customer to place the order using these PDA devices. The waiter collects the PDAs from the customer so that another customer can use it.

This system is a step forward to an automated food ordering system over the traditional pen-and-paper, but it has many limitations such as increasing the restaurant expenses

during the peak hours as during those hours the restaurant needs large numbers of PDAs to serve every customer.

Using the PDA based system, there is no way to get real-time feedback from the customers.

The PDAs user interfaces are not effective as it consists of only text information of the menu with no images or prices of the food (Kasavana, 2001).

### 3.2.3 KIOSK System

Another ordering system for restaurants is the KIOSK system (Pendrill, 2020) which is a screen that contains the complete menu of the establishment and is usually installed near the cash counter. It is more advanced than the previously discussed systems as it also includes the prices and the images for every item in the menu.



Figure 3 - KIOSK System  
Source: [microtekuk.com](http://microtekuk.com)[online]  
[What We Repair – Microtek UK](#)

When a customer enters the restaurant, they check the food menu at the KIOSK screen, search through the list, select the desired food items and complete the order. The payment is completed through the same system screen choosing a suitable option.

The customer receives a receipt with an order number, and once the order is ready, it is displayed on the screen at the cash counter from where the customer will collect it.

This process is more advanced than the discussed ones, but it has its limitations, such as if the restaurant is in its busiest hours, the system creates a substantial queue to access the KIOSK screen which leads to inconvenience and frustration among the customers. This is the reason why KIOSK is mostly used in quick order restaurants such as fast foods (Pendril, 2020).

### **3.2.4 Click & Eat Solution**

To overcome the restrictions of the above systems and help with the current pandemic climate, the Click & Eat system is proposed.

With this solution, the customers can browse the menu, order and pay using their device without the need of downloading an app or signing up for an account.

The customers can order and pay when they are ready while maintaining minimal contact with staff, menus, money or payment devices.

This application enables customers to take the ordering and payment process into their own hands. They will be presented with a QR code placed on each table which will be scanned using their mobile phone camera to access a digital menu. They will browse the menu to craft their order, submit their order and pay for their meal all while maintaining minimum customer-staff contact.

The restaurants can see the benefits of the increased spend through easy upsells, the ability to send special offer notifications to their customers once they leave, reduced staff cost as the customers self-serve by ordering and paying on their own and increase the number of diners as the experience is safer due to reduced interaction.

## **4. Market Analysis**

### **4.1 The Importance of Technology in the Restaurant Industry**

Historically, restaurants tended to shy away from adopting new technologies because it was viewed as adding costs to the already slim profit margins. However, in the last decade, there was a steady increase in restaurants that realized the importance of technology for their business.

In the technological transformation era, restaurants have moved from cash registers to today's high-tech online booking systems as well as automated ordering systems.

The first revolutionizing technology used by restaurants was the well-known POS system which fit well into the industry by automating the work of waiters and kitchen staff.

The POS was able to save precious time and was a much more effective way to perform tasks like writing the orders and delivering them to the kitchen.

A significant advantage of this initial POS system was that servers were no longer needed to remember or input prices on handwritten bills. Also, very important, the POS system had a positive effect on service quality.

Nowadays, the restaurant industry still uses POS systems, although the technology has become more sophisticated and useful from a managerial point of view. Vendors are continually seeking to outperform and attract business by adding new convenient features to their systems (Anon., 2017).

From its slow start, the entire industry has made progress in using technology to push ahead in several aspects of their industry. Ultimately, technical innovations, developed initially to help organizational productivity and decrease labour, food and other operational costs, have helped businesses to achieve the ultimate goal, customer satisfaction and repeated business.

Studies have shown the use of technology with the industry's drive to enhance customer service has resulted in increased customer satisfaction (Char, 2019).

The Restaurant Technology Survey released by the National Restaurant Association (NRA) offers an insightful understanding of how restaurants are using the technology and what is on their agenda for the future.

The figure below shows what the restaurant operators agreed, with regards to using technology in their premises.

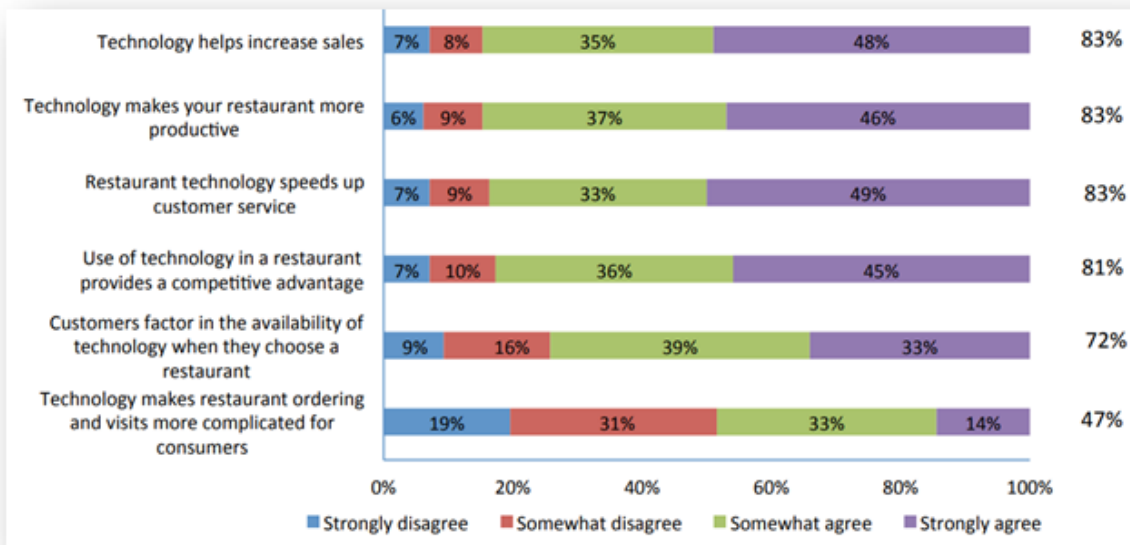


Figure 4 - Restaurant Technology Survey by NRA USA  
 Source: blogs.oracle.com [Online]

<https://blogs.oracle.com/hospitality/how-is-technology-helping-restaurants-today-and-tomorrow>

As per restaurant proprietors, technology is not just about taking orders. 83 percent of restaurant operators claim that technology plays a role in raising revenue, efficiency and customer service. 81 percent claimed that technology had provided them with a competitive advantage.

All of this indicates clearly that technology should be a strategic part of every restaurant operation (Simcock, 2016).



## **4.2 Technologies Changing the Restaurant Industry**

From ordering online applications, table tablets, Wi-Fi and mobile payment, technology in restaurants has become popular and is in continuous expansion.

Every restaurant is slowly adopting and investing in technological innovations in order to meet their customers' expectations.

In recent years the innovative developments presented below, in the food service sector, changed the way restaurants do business, in kitchens and in front of the house.

The hospitality business, both for the owners and the clients, is changing and developing at a rapid pace. Technological innovation, along with modern-day customer demands and aspirations, is largely driving this evolution. This poses exciting opportunities but also major challenges for everyone running a hospitality company to keep up-to-date with the speed of change (Fulmer, 2019).

Before 2020, the world of restaurant technology was already changing rapidly, but the COVID-19 pandemic brought much greater uncertainty and intensified the rate of transition. With that in mind, in the years ahead, it's worth considering what most hospitality companies would look like, and how they would function.

Presented below are some main tech-trends and their effect on shaping the future of the restaurant industry (Ward, 2020).

### **4.2.1 Drones taking to the skies**

This idea may sound a little 'pie in the sky' (Ward, 2020) but, quite literally, it's on the verge of taking off. Drone technology is increasingly establishing itself internationally and could even become the future restaurant delivery method of choice.

Drones in the execution of food delivery could become very common in the near future. There are companies that are looking into developing this new technology that could accelerate food delivery significantly (Ward, 2020).

### **4.2.2 Online ordering expanded**

Over the last five years, the growth of digital ordering solutions across restaurant websites and applications has perhaps been the largest change in the hospitality industry.

The COVID-19 restrictions intensified the movement towards online ordering. Customers tend to have an overwhelming preference for ordering directly from their local restaurants and takeaways, rather than through marketplaces, in order to help save their beloved restaurants from closure during the crisis.

While a lot of the technology and software that drives digital ordering is already with us, it is continuously evolving. In the decade ahead, online ordering is likely to become increasingly essential in the operation of restaurants and increasingly popular with customers (Ward, 2020).

### **4.2.3 The increasing role of data**

As transactions are processed, online ordering systems and modern POS systems produce vast amounts of data, and these analytics should be taken advantage of by restaurant owners. It is incredibly precious, and not something that can be overlooked or turned over to someone else. It should be the driving force behind the business development plan of a restaurant. For example, the most popular dish in the restaurant can be easily identified, and the menu can be updated using the sales figures data.

Even if data can be seen as a cold and hard area in an organization, it is actually playing a major role in creating a relationship with the customer, being able to know them, their behaviours and desires which will help in customizing their experience.

Key marketing and loyalty programs can be driven by strong customer data, helping to power the business growth. This trend will undoubtedly become more ingrained over time as the available data becomes more sophisticated and actionable (Edwards, 2017).

### **4.2.4 Robots working in the kitchen**

A hamburger-making robot (Fort, 2018) has been created by a company in California. It can produce burgers at high speed and impressive volume. They have spent nearly a decade designing and developing the machine with funding of millions of dollars.

Products like this have great potential with the ability to automate much of the labour-intensive food preparation work. However, it remains to be seen whether and when they will be widely accepted in the industry and if the robots will actually take the place of kitchen workers and prepare meals regularly in years to come (Naylor, 2019).

### **4.2.5 Augmented Reality**

There are several Kiosk options that bring restaurant service performance to whole new heights as we step further into the technological world. The technology of augmented reality produces an illusion that was probably only seen in movies.

Augmented reality enables the customers to see a 360-degree visual rendition of each menu item right in front of them. This helps the customer and the waiter to go back and forth less by reducing the miscommunication that can result in food being sent back to the kitchen. Less food waste means higher turnover for the business.

Many restaurants are already using this new technology to complement and elevate their customer's experience (Alamgir, 2019).

In the modern age, mastering restaurant technology is all about offering customers the best comfort and value.

Succeeding with a branded mobile restaurant app, or even an online ordering platform, means that the business has to understand how to use these restaurant tech resources to boost, not entirely alter the current customer experience.

### **4.3 Similar Applications**

Order and pay technology are not new in the quick-serve restaurant industry. From order, pay and get loyalty points apps to self-service kiosks, fast-food chains are offering their customers these options which provide significant benefits to both the customer and the business.

This is very common for fast food type restaurants, but there are already solutions for the sit-down, table service restaurants which have proved to bring improvements in customer experience and increase operational efficiencies for the establishment.

The pandemic has a significant impact in using mobile ordering, driving more customers to download restaurants apps which resulted in an opportunity for the technology industry to come up with ideas that will help the restaurants in these times of crises.

Click & Eat proposes to develop a product that will offer the ultimate guest convenience, streamline the restaurant operations, improve the order correctness,

reduce contact between staff and customers and boost the business revenue by encouraging repeated visits.

In the following section products available in the market that are similar to the proposed project, will be discussed.

### **4.3.1 Just Eat**

Just Eat (Team, 2020) is a global well-known online food delivery service founded in 2001 in Denmark, which operates in 13 countries around the world, and it acts as an intermediary between restaurants and customers. The application allows customers to search for local restaurants that operate takeaways, place orders for their food, pay online for the order and choose for pick up or delivery options.

It is a web application and has cross-platform mobile applications available on the Google Play Store and iOS App Store providing choice to the customers to use it from a web browser or can download the app on their mobile phone (Browne, 2020).

Just Eat uses mainly a Microsoft technology stack for the development and for adding new features to it. It uses DynamoDB, which is a schema-less NoSQL database hosted by Amazon Web Services (AWS) that has auto-scaling, read-write capacity management and alerts control using CloudWatch (Team, 2020).

Just Eat is similar to the Click & Eat application proposed in this document in terms of ordering and payment. It is different because it addresses only the delivery of the order and the application for this project is going to be used for orders and payments at the table in the restaurant.

### **4.3.2 QikServe**

QikServe (O'Neill, 2018) was founded in 2011 and is headquartered in Edinburgh and US base in Atlanta Tech Village. This application is very similar to the proposed project as it offers the same services for restaurants and the restaurant customers.

QikServe is a platform for customer self-service in restaurants. Restaurant operators can have in-store self-service solutions by using this product from Kiosks, tablets, mobile phones or online, allowing customers the flexibility to order and pay for their order whenever they want.

The development of the product range across iOS, Android, Web and UWP applications implemented using technologies like React, AngularJS, C#, Java, HTML, CSS and SQL, NoSQL databases (O'Neill, 2018).

### **4.3.3 Flipdish**

Flipdish (O'Hear, 2018) was founded in Dublin in 2015, and it is an online ordering system that allows restaurants, pubs and takeaways to accept online orders and payments from their customers.

With Flipdish table ordering, like with the application proposed in this document, the customers can order and pay from their table, using their mobile phone by scanning a QR code which will bring them to the menu and the payment option (O'Hear, 2018).

The technologies used by Flipdish to develop their software solution comprise mostly of a Microsoft technology stack.

### **4.3.4 OrderPay**

This is an aggregator app which works by platforming different brands. Customers only need to download the OrderPay app once, and the functionality and native app advantages will be unlocked for that particular restaurant in which it is used. OrderPay locks the app if the customer crosses the entrance of a different establishment (Quach, 2020) This is realized using Beacon technology.

Beacons are transmitters to send signals to smart devices and used in location technology and proximity marketing. (Fisher, 2020) A customer that has the OrderPay application downloaded and is on the right site uses a QR code for self-service similar to the Flipdish ordering described above.

The COVID-19 crisis signalled an order-at-the-table tech revolution. Restaurants, cafes and bars are now seeking different solutions to be able to keep their business running.

Mobile ordering is put in place, and applications are developed to give customers a comfortable and safe way of ordering their meals and drinks. These applications let diners order ahead, pay instantly with a reduced face-to-face contact and no use of card machines, helping prevent the spreading of the virus via physical contact.

This approach of ordering and payment can be seen as a benefit for the long term of the business as it reduces staffing costs, increases profit through easy upsells, gathers data about customers which as mentioned before is important in adjusting the menu choices as well as pushing marketing notifications using their contacts.

#### **4.3.5 Interviews**

From an interview conducted on the 12<sup>th</sup> of September 2020, the manager of Batonis Restaurant, Mr. Adrian Rusan stated *“With COVID-19 pandemic as a daily reality, our main concern is not only surviving the crisis but to find different ways to reinvent our business by giving our customers the opportunity to avail of our products and offers in a different manner, more approachable, safer and easier than ever before. Therefore in order to implement all these requirements for a much better customer experience, and to eliminate the very understandable fear of the virus, I think that the application described would be a great tool to achieve these goals and encourage customers to have new confidence in coming back to our restaurant. Batonis restaurant is always looking for new ways to significantly improve the customer experience, and with the challenges we face these days, our approach to embrace Click & Eat is a statement that technology is becoming, more than ever, a very powerful method in dealing with everyday business operations. Click & Eat will also become a household engine that will eliminate waiting times and friction associated with ordering and payment and we are looking forward to using it.”*

When the head waiter of Batonis Restaurant, Mr. Stefano Peccenini, was asked about using Click & Eat, the answer was: *“Batonis Restaurant is a very busy restaurant especially during the weekends and this application could be a great help for us as the biggest amount of time spent by the waiters is taking the orders and receiving the payments. This way we can spend more time delivering the orders and most importantly responding to our customer needs and offering them an even better service which means happy customers, good profit and big tips. A problem I can see is that not all of our customers will like the idea of ordering from their phone so I think we will need to keep our manual ordering and cash or visa payments too. A benefit that I can see also from using this application is that in these pandemic times it can bring back the customers because it reduces the human interaction and they will be more confident to dine in our restaurant. I agree to give it a try and see how it will change and improve our job and the restaurant sales and day to day activities.”*

Researching the market and getting opinions from people involved in this industry, it became optimistic that Click & Eat has great potential to be adopted in the restaurant's operation.

The application will streamline the restaurant's functioning by simplifying the ordering and the payment for both customers and staff and will allow collecting valuable customer data to better understand them and drive targeted marketing campaigns.

## **5. Relevant Technologies**

### **5.1 Web Applications Categories**

A web application is an application software that runs on a web server, in comparison to smartphone apps, which are stored locally on the device's operating system. Web applications are accessed by users through a web browser with an active internet connection, and unlike native applications, they do not require downloading.

Web Applications are interactive websites that provide functions such as communicating with users, linking to back-end databases, and producing browser results in conjunction with server-side programming.

The norms and standards for online experience have grown along with web application development innovations (Malhotra, 2020).

Click & Eat is going to be a web application, so the customer will not have to spend time downloading it into their phone, and in order to evaluate what type of application is the best fit for it, relevant categories of web applications will be described below.

#### **5.1.1 Static Web Application**

All web applications are, either static or dynamic in terms of technical implementation. Yet, while 'dynamic' is a broad group of subtypes, 'static' can be regarded on its own as an architectural form.

The word 'static' comes from the lack of versatility of these web apps. Static web apps have server-generated pages and provide little or no interactivity. Typically, there is no space for personalization and only after a complete page reloads any potential change takes place.

Static web pages are often difficult to manage, and the risk of poor results are generated by the excessive amount of data they submit and receive. This is why static web applications are not the right choice for a mobile environment, but they can be a hands-on choice when very succinct information is shared, and interaction is not necessary (Yaskevich, 2018).

### **5.1.2 Dynamic Web Application**

A dynamic web application is based on the usage of frameworks which are software that controls the web page construction and enables maintenance. The way these web applications are presented to the user is not predetermined but rather dynamically shaped by the applications logic, which is implemented on the server or the client-side of the app.

Dynamic web applications vary in how they run, and their use cases decide their development approach and architecture (Yaskevich, 2018).

### **5.1.3 Multi-Page Application**

A multi-page web application has most of the logic on the backend, meaning that for any change to take effect, all client requests need to go to the server and back. This concept was almost identical to that of static web applications in the past, aside from the use of frameworks.

This problem was solved with the use of Asynchronous JavaScript and XML (AJAX) technology which enables instant changes without a full page reload. These web applications can adapt to the mobile environment if they are designed responsive enough.

Multi-page applications are highly secure because the logic cannot be accessed by the user and therefore are mostly used for web portals and enterprise web applications (Neoteric, 2016).

### **5.1.4 Single Page Application**

Single page web applications let users interact with a web app from a single page due to the logic implemented in the client-side. The interaction is instant, as requests and responses communicate in small amounts of data and happen almost instantly.



Any web application improves significantly after becoming single paged. They are specially used for social networks, online videos, email services applications because of their agility.

Single page application improves the application's performance and consistency and reduces time and infrastructure costs (Lawson, 2018).

### **5.1.5 Progressive Web Application**

Using the latest technologies, a progressive web application blends the best of web and mobile apps. Progressive web applications (PWA) are like a website built using web technologies, but they act and feel like a native app.

These applications take advantage of the much broader online environment, plugins and culture and the relative simplicity of installing and maintaining them when compared to a native application. A progressive web application works on any device and improves progressively, taking advantage of all features available on the user's device and browser. Web applications built progressively are discoverable in search engines which represents a significant advantage over native applications, which still lag behind in searchability. Another great feature of progressive applications is responsiveness which means that their user interface must fit the device's form factor and screen size. (Farrugia, 2016)

When developing a web application, the most important thing to consider is the technology stack on which the application will be based on.

There are two sides to web development: the client-side also referred to as front-end, and the server-side also called the back-end. The client-side web development involves everything that the user can see on their screen. The server-side involves the programming language that powers the application, a database and the server itself.

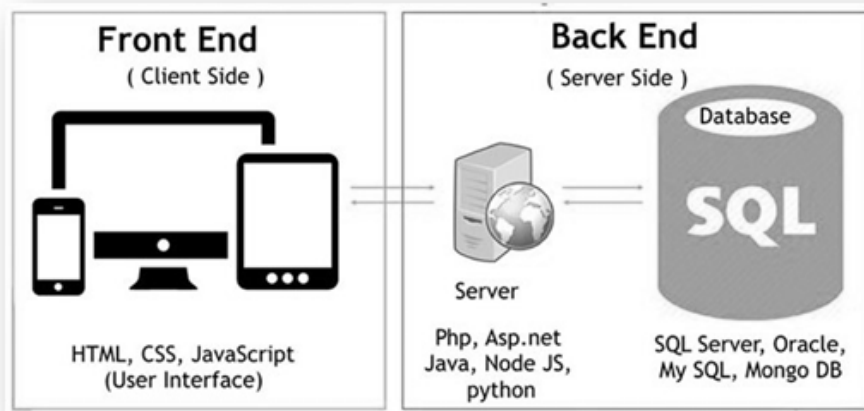


Figure 5 - Full Stack Web Development

Source: dryanchristoph.com [Online]

<https://dryanchristoph.com/2019/03/24/2nd-web-development-tutorial-basic-concept-of-php-html-mysql-javascript-css/>

The section below will explore technologies and development environments that can be used for building the Click & Eat web application. The aim is to research what technologies are already used and to decide which will be the best suited for the proposed application.

## 5.2 Front-End Technologies

Many different languages and libraries make up the front end stack.

Although they differ from application to application, all web browsers understand only a few generic languages. HTML, CSS and JavaScript are the three main front-end coding languages, and all existing libraries are built upon these. (Lindley, 2019)

### 5.2.1 HTML

HTML (Hypertext Markup Language) is the key front end technology, the first layer of a website or web application composed of a series of shortcodes called tags, normalized into a text file. The browser scans the text file and interprets it into a visible form and renders the page as the designer planned.

HTML defines elements like headlines or paragraphs, allows embedding of images or video but it isn't particularly intelligent as it simply renders the scaffolding of the web pages (Vikram, 2019).

## 5.2.2 CSS

CSS (Cascading Style Sheets) is used in style sheets design to define how HTML elements should be displayed on a web page in terms of design, layout, and appearance scaling for devices with different screen sizes.

CSS dictates the presentation of HTML elements on a page.

CSS allows presentation and content separation, including layout, colours, and fonts. This separation will improve the usability of content, provide more flexibility and control in the presentation function specification, allow multiple web pages to share formatting by defining the required CSS in separate files (Vikram, 2019).

## 5.2.3 JavaScript

JavaScript is a very popular scripting language, and it is what makes the website alive. JavaScript ensures that when a web page is open, it loads both the page's standard basic JavaScript and any new JavaScript added to the page. In parallel with it, the fresh JavaScript will load and can perform actions and make decisions.

JavaScript is used to build and manage website content such as anything that moves, refreshes or changes on the screen without manually reloading the web page (Rauschmayer, 2020).

## 5.2.4 Front-End Frameworks

The software framework is a pre-written app structure that the developer can construct on top of. It is practically a list of files and directories to which the programmer adds their files and code. A framework is intended to help to build the application faster, but it is still an assistant, not the full solution of the front end development.

Front end frameworks usually include grids that make it easy to organize the website's design elements in creation, specified font styles, pre-built components such as panels, buttons, navigation bars (Bradford, 2019).

#### **5.2.4.1 React**

React (Dua, 2020) is an open-source framework developed at Facebook in 2011 to help with code maintainability issues resulting from the constant addition of features in the app.

React is the most popular JavaScript library for building fast and interactive user interfaces and it is an ideal framework for high traffic pages that need a stable platform to handle it.

React is recommended for projects such as single-page web applications and PWAs which are applications intended to work on any platform that uses a standard browser including both desktop and mobile devices.

React enables reusability of components which makes it easy to collaborate and reuse them in other parts of the application.

React allows designing simple views for each state in the application, and it will efficiently update and render the right components when the data changes. These are called declarative views and make the code more predictable and easy to debug.

At the core of all React applications are components which are essentially a piece of the user interface. Building applications with React means building a bunch of independent, isolated and reusable components and then composed them to build complex user interfaces. Each React application has at least one component, referred to as the root component. This component represents the entire application and contains other child components so every React application is essentially a tree of components which can be reused on other pages or even in different applications (Dua, 2020).

#### **5.2.4.2 Angular**

Angular (Mistry, 2020) is an open-source framework based on TypeScript, launched in 2016 by Google to bridge the gap between the increasing demand of technology and concepts that showed results.

Unlike React, Angular is unique because of its two-way data binding feature. This represents a real-time synchronization between the model and the view, where any change in the model is reflected instantly on the view and the other way around too.

Angular can be used to build mobile applications or web applications or progressive web apps.

In comparison to React, Angular is harder to learn, and the documentation available can be quite complicated and confusing to read.

Angular enhances the performance of browser-based applications by dynamically updating the contents in no time since it uses two-way data binding. Angular is mostly used for enterprise based applications and dynamic web applications (Mistry, 2020).

#### **5.2.4.3 Vue.js**

Vue.js is an open-source model-view-viewmodel JavaScript framework for building user interfaces and single-page applications and considered very simple and straightforward removing the complexity of the Angular framework.

This framework is smaller in size, flexible, is component-based and also a two-way binding and supports multiple tasks.

It allows building web applications, progressive web applications, mobile apps and can handle both simple and dynamic processes, but it is not popular among market giants.

Vue.js has extensive and detailed documentation, simple syntax, typescript support, and it has the flexibility to design the app structure (Ball, 2019).

#### **5.2.4.4 Blazor**

Blazor is a UI framework for .NET that enables the build of the entire web application with just .NET. Blazor allows developers to build responsive, single-page applications without having to use JavaScript.

Blazor apps consist of reusable components of the web UI that are implemented using C#, HTML, and CSS. The client and the server code are written in C#, allowing code and libraries to be shared.

Using WebAssembly, Blazor can run the client-side C# code directly from the browser. The code and libraries can be reused from server-side parts of the application because it's real .NET running on WebAssembly.

As another option, Blazor can run the client logic on the server. Using SignalR, which is a real-time messaging framework, client UI events are sent back to the server. The desired UI changes are sent to the client and merged into the DOM once the execution is completed.

Blazor WebAssembly offers support for building Progressive Web Applications (Sainty, 2020).

#### **5.2.4.5 Bootstrap**

Bootstrap is a potent client-side HTML, CSS and JavaScript framework that focuses on the web creation of mobile-like applications. The developer toolkit of Bootstrap offers the ability to build custom web apps by using pre-built components that can also be modified to incorporate responsive features. It includes templates based on CSS and JavaScript for typography, shapes, buttons, navigation and other components of the interface.

The key advantages are that it is design-responsive, retains broad compatibility with the browser, provides consistent design through the use of re-usable parts, and is very simple to use and fast to learn (Bacinger, 2020).

### **5.3 Back-End Technologies**

In order to make the server, application, and database communicate with each other, back-end developers use server-side languages like Java, Python, C# to build an application, and tools like MySQL, MongoDB, and SQL Server to find, save, or change data and serve it back to the user in front-end code.

Server-side scripting provides many benefits, including, but not limited to, ease-to-add, content modification via content management systems, improved protection and faster loading time.

The key benefit of server-side scripting is its ability to highly customize responses by taking user-specific requirements and queries into account and making device-specific performance through responsive web creation.

A large number of factors affect the choice of server-side programming languages, including the general preference of the developer, particular site specifications,

responsive web development needs, and the configuration of the database and operating system.

Before making a decision, it is recommended to thoroughly evaluate and compare the many features, benefits, limitations, variety and functionality of each language (Thor, 2020).

### **5.3.1 Java**

Java is an object-oriented programming language and one of the most popular languages in the world. The Java language, modelled after C++, was designed to be easy and portable, both at the source and binary level, across platforms and operating systems.

In 2010 Java became the most common option for object-oriented programming, but more features were introduced in 2014. The "Lambda" expression was included in the Java 8 release in 2014, giving developers the ability to write their functional-oriented applications.

Oracle estimates that Java is the most common runtime environment used by enterprises, and more than three billion devices use Java. Its popularity is due to the simplicity as developers find it easy to learn, it is familiar as many developers started with C/C++ languages and Java is similar, so it is learned quickly. Developers prefer it because it removes C/C++ complexity like pointers, and the language enables automatic garbage collection, turning it into a robust programming language.

For several small applications where it can achieve the same result with something simpler, Java is overkill. That is why it is used by many large business applications, such as those in banking and insurance, to connect with other systems, such as mainframes (Schulman, 2020).

### **5.3.2 PHP**

Another open-source scripting language used on the server-side is "PHP: Hypertext Preprocessor," which previously stood for "Personal Home Page." In various large giants, such as WordPress and Facebook, it is very popular. The PHP language can only be interpreted by a PHP-installed server, and its file ends with the .php extension.

PHP is considered a stable language as opposed to other languages. It can be easily integrated with databases such as Oracle, MySQL, PostgreSQL.

PHP is straightforward to understand. Being open-source, it comes with comprehensive documentation with detailed language details, making it simple for even beginners. The growth and debugging is made easier by a broad support group.

PHP provides more versatility than other scripting languages. Core functionalities can be expanded through libraries created by developers around the world as per individual development requirements. It is also possible to easily embed custom extensions and components into the source code.

PHP is used to build stable, secure, dynamic and interactive websites, ranging from simple blogs and data forums to complex websites for e-commerce and chatting (Morris, 2020).

### **5.3.3 C#**

C# is one of the most familiar programming languages developed by Microsoft that runs on the .NET Framework, and it is used for a range of items including mobile apps, games and web applications. C# is a simple, modern, general-purpose and object-oriented language and primarily used on Microsoft Windows.

Compared to more complex languages such as Java, the learning curve for C# is relatively low, but it is not quite as easy to learn as Python, the ultimate programming language for those who are brand new to the area.

This programming language is statically typed, ensuring that before the application goes live, errors are found. This makes it much easier to find minor defects in the application stack that would otherwise be almost imperceptible.

C# is a remarkably scalable and easy to maintain programming language.

C# programs are consistent due to the rigid nature of static codes that must be written, which makes them far easier to modify and maintain than programs that are written using other languages (Svetlin Nakov, 2013).



### **5.3.4 Python**

Python is a flexible and popular interpreted programming language for general purposes.

It is succinct and easy to understand, and it is also a good language to have in the stack of every programmer as it can be used for anything from web creation to development of software and science applications.

Python is open-source and offers support from a broad developer community for developers. For several commonly used programming activities, the standard library includes scripts that significantly reduce code duration and execution time.

Python is an object-oriented programming language that allows reusable data structures that minimize repetitive work and mostly used for the development of robust, flexible, scalable and responsive web applications.

In terms of speed, Python can be slower than other scripting languages because it works with an interpreter instead of a compiler which can affect performance (Bynum, 2019).

### **5.3.5 Back-End Frameworks**

Back-end frameworks or also called server-side web frameworks, make tasks like protecting APIs from attacks, authorizing users, facilitating interaction with databases, routing URLs to databases to fetch information requested by the client.

The goal of back-end frameworks is to assist with the development of the apps and to accelerate the time needed to build the application. Below are described a few of the most popular back-end frameworks in order to choose the best option for developing the Click & Eat application recommended in this paper.

#### **5.3.5.1 Flask**

Flask is a lightweight python back-end web application framework designed to make getting started easy and quick and which has the ability to scale up to complex applications.

Flask, at the beginning was just a wrapper around Jinja, a HTML templating system, and has become one of the most popular Python web application frameworks.

This python framework allows developers to build customized and scalable applications and it is very flexible because it can be quickly set up and it does not impose dependencies on developers enabling them flexibility in their development (Clark, 2020).

#### **5.3.5.2 ASP .NET Core**

ASP.NET Core is an open-source platform that continues in the footsteps of ASP.NET, a commonly used backend built in cooperation with the .NET Foundation.

ASP.NET Core is a modular framework that can run on Windows and .NET Core through the entire .NET Framework.

Production of web apps requires developers to ensure support for all platforms is supported by an application. A cross-platform web application backend architecture that provides support for different platforms is the latest ASP.NET framework.

ASP.NET Core utilizes software that needs less programming. It means that developers find it very easy to use the backend as they have to make fewer statements. Less code translates to less time needed for an application to be developed. A small amount of code is easier to maintain, and with just a few statements, the developers can also easily apply optimisations as needed.

ASP .NET Core offers developers the choice of using asynchronous programming patterns, which means that a unit of work runs separate from the main application thread and notifies the calling thread of its completion.

One of the main features of the ASP.NET Core back-end framework is performance, it one of the most agile web application frameworks (Clark, 2020).

#### **5.3.5.3 ExpressJS**

ExpressJS is an open-source Node.js web application framework, released in 2010 and used for building APIs and web applications and usually used as a stack back-end component along with the AngularJS front-end framework and MongoDB databases.

This framework is minimalistic, fast, easy to set up and straightforward to learn, it offers a great routing API, it avails of a large number of plugins and offers numerous HTTP utility methods to build dynamic and perceptive APIs (Tripathi, 2020).

## 5.4 Databases

Since their introduction in the early 1960s, databases have significantly grown.

The original structures used to store and manage data were navigational databases, such as the hierarchical database which relied on a tree-like model and permitted only one-to-many relationships, and the network database, a more versatile model that allowed multiple relationships.

Relational databases became popular in the 1980s, followed in the 1990s by object-oriented databases. More recent, NoSQL databases arise as a response to internet growth and the need for higher speed and unstructured data processing.

Today, when it comes to how data is processed, stored, handled and used, cloud databases and self-driving databases break new ground (Erik Gregersen, 2020).

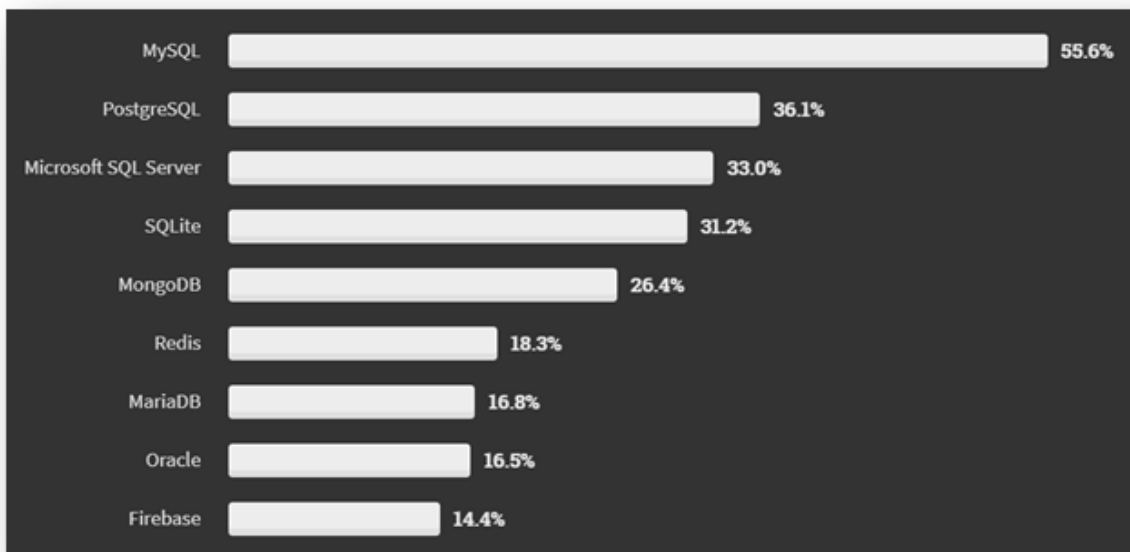


Figure 6 - Popular databases 2020

Source - [insights.stackoverflow.com](https://insights.stackoverflow.com) [Online]

<https://insights.stackoverflow.com/survey/2020#overview>

The image above shows the most popular databases used in 2020 based on a Stack Overflow survey conducted in February 2020, where 65000 developers were asked what tools they are using.

Describing some of these databases will help to decide what will be the best choice for using in the development of the Click & Eat application.

### **5.4.1 MySQL**

MySQL is an open-source relational database management system that organizes data into tables. Each table is assigned a Primary Key, often an Id. This can be used to relate multiple tables together, helping this way to structure the data. A table is a collection of data, and it consists of rows and columns.

MySQL allows developers to create, modify and extract data from the tables and control the users access to the database. Big applications like Facebook, Twitter, YouTube, Google are using MySQL for data storage purposes.

MySQL has available host-based verification and password encryption (Jain, 2020).

### **5.4.2 MongoDB**

MongoDB came into light in 2000 and is a document-oriented NoSQL database used for high-volume storage of data.

MongoDB makes use of sets and records instead of using tables and rows, as in conventional relational databases. Documents consist of key-value pairs in MongoDB which are the basic data unit. Documents and feature sets that are identical to relational database tables can be found in the collections. Fields in these JSON-like documents can vary from document-to-document, and the data structure can be easily changed over time.

MongoDB is free to use, and the special queries, indexing, aggregation in real-time makes this a database that provides powerful ways to access and analyze the data (Rouse, 2020).

## **5.5 Testing technologies**

Software testing is a way of verifying whether the actual software product meets the expected specifications and ensuring that the software product is free of defects.

It necessitates the use of manual or automated methods to test one or more properties of interest using software/system components. The aim of software testing, in contrast to real specifications, is to identify errors, gaps, or missing requirements.

Application Testing is characterized as a form of software testing carried out via scripts to detect software errors. The whole application will be examined to help enhance the quality while reducing cost and ensuring that a particular program or the application features function correctly.

Application Testing has many testing methods. Tool range is dependent on what kind of application needs to be tested. Different tools are recommended for various platforms. Tools for application testing ensure application consistency, accessibility and functionality across a range of devices.

A sure way to identify flaws in the application is to choose the best technique for Application Testing in order to find further errors and with less time in the application to be developed (Dolan, 2020).

### **5.5.1 Selenium**

Selenium is a simple and compact testing framework for applications primarily used for web application testing. For automation of the browser, Selenium functions as an API. Selenium is commonly used, free and open-source framework for web application automation testing across multiple browsers and platforms.

Selenium is used for regression testing and functional testing of web applications and supports many programming and scripting languages such as Java, C#, PHP, Python for coding the logic of the test scripts (Vardhan, 2020).

### **5.5.2 Katalon Studio**

Katalon Studio is a full cross-platform test automation solution for web, mobile, API and desktop applications. It is built on top of the Selenium framework. This testing tool transformed the usage of the test automation framework by removing the technical complexities and allowing testers to effectively set up, create, run, report and manage automated tests easier and more efficiently.

Katalon studio comes with a friendly UI which allows quick and easy test environment setup and has pre-built templates and test scripts. Katalon Studio supports cross-platform testing on all popular operating systems and it is a great option for beginner testers as it has a ready-made framework, a built-in recorder and predefined test methods (Ereiz, 2019).

### 5.5.3 TestComplete

TestComplete is another powerful, rich in features automated web testing system that allows parallel, cross-browser, regression testing and provides all capabilities expected from a robust automation system.

With TestComplete, the tests can be recorded, scripted or manually created with keyword-driven operations and used for automated playback and error logging.

This record and playback method records a tester performing a manual test and allows it to be played back over and over again as an automated test. This means that the recorded tests can be modified later to create new tests or intensify existing ones with more use cases (Acharya, 2019).

## 5.6 Token Based Authentication vs Session Cookies

A session or a token could be used to address the stateless nature of HTTP requests. After the user logs in with session-based authentication, the server will establish a session for the user. The session id is then saved in the user's browser as a cookie.

The session id is then saved in the user's browser as a cookie. The cookie will be sent with each subsequent request as long as the user is logged in. The server will then verify the user's identity by comparing the session id stored on the cookie to the session information stored in memory and sending a response with the appropriate state(Hsu, 2018)

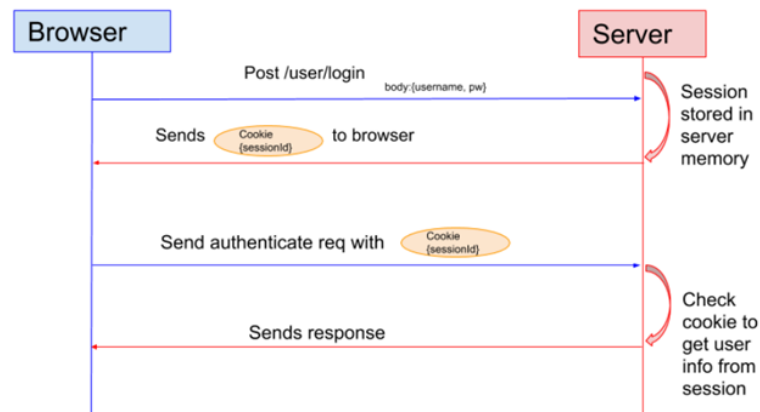


Figure 7 - Session authentication

Source - [medium.com](https://medium.com/@sherryhsu/session-vs-token-based-authentication-11a6c5ac45e4) [Online]

<https://medium.com/@sherryhsu/session-vs-token-based-authentication-11a6c5ac45e4>

For authentication, many web applications nowadays use JSON Web Tokens (JWTs) rather than sessions. The server generates a JWT with a secret and sends it to the client in a token-based application. The client saves the JWT (usually in local storage) and includes it in any request's header. When the server receives a request, it validates the JWT and sends a response (Hsu, 2018).

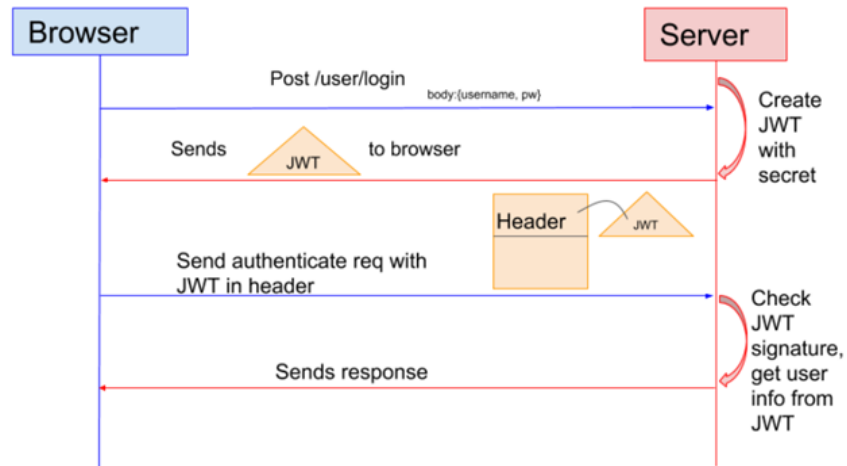


Figure 8 - Token authentication  
Source - [medium.com](https://medium.com/@sherryhsu/session-vs-token-based-authentication-11a6c5ac45e4) [Online]

<https://medium.com/@sherryhsu/session-vs-token-based-authentication-11a6c5ac45e4>

The most significant difference is that the user's state is not stored on the server but rather inside the token on the client-side. JWT is used for authentication in most modern web applications for a variety of purposes, including scalability and mobile device authentication.

In modern web apps, JWT-based token-based authentication is the preferred method. One disadvantage of JWT is that it is much larger than the session id stored in the cookie because it includes more user information (Hsu, 2018).

Instead of the standard method of creating a session in the server and returning a cookie, when a user logs in successfully using his credentials, a JSON Web Token will be returned and must be stored locally, typically in local storage (Otemuyiwa, 2016).

## 5.7 Authentication and Authorization with JWT

In a system, there are resources that need to be protected, and that can be done by having a trusted computing base. Every request that comes for a resource has to be monitored in order to see if that request should be able to access the desired resource. To establish that, it needs to know whom the request is coming from, and this is done by identifying who is making the request with the use of authentication and authorization.

Both terms, authentication and authorization are commonly used in the context of security of the systems.

Authentication (Rosencrance, 2020) refers to the process of proving someone's identity to be true with the purpose of controlling access to a protected resource such as a system, an application, files or networks.

The authentication process begins when the user arrives at the login page and subsequently enters their username and password or any other security token. The introduced credentials are then compared to the credentials stored within a database at the registration time. If the credentials submitted by the user match the credentials stored in the database, the user gains access, else their access is denied.

Authorization (Piscitello, 2015) is a concept which is strongly related to another concept called roles. Authorization means allowing or denying permissions based on roles. This concept is the security guard examining what a user wants to do and then deciding if they are allowed to do that.

It is essential for a system to have a stable and optimised authentication process. This is not only from the user point of view but also to maintain credibility and mitigate the effect of any potential data breach, which unfortunately happens very often.

Click & Eat is developed as a single page application, and after researching Authentication and Authorization mechanisms in the research document, it was decided that Token Authentication and Authorization meet the requirements needed.

As a single page does not incorporate page refreshes, an API server was needed to be developed that could be queried in real-time. Using JWT authentication, no identity or user information is managed directly by the application. Alternatively, all the information the application needs is taken from the JWT token that authenticates a call.







After the token is generated at login, it is stored in the database. The token then gets attached as the authorization header in the response to the login request.

The server decodes the authorization token and extracts the ID from the payload when it receives a request with an authorization token attached. Then it verifies the user in the database with that ID, and it compares the request token with the one stored in the database. If they correctly match, the user is authenticated.

At logout, the token attached to that user will be deleted, and that token will no longer work. The user will need to login to generate a new token (Gore, 2020).

Because the JSON object is digitally signed, the information contained within it can be checked and trusted. JWTs may be encrypted to provide confidentiality between pirates, but they are usually signed also. Signed tokens can verify the validity of the claims they contain, while encrypted tokens keep those claims hidden from third parties. JWTs are usually signed with a secret algorithm (seen above an HMAC algorithm). However, if the JWT is delivered over an unsecured network, a malicious user can seize the base64 encode JWT and try to modify the payload section. Because the malicious user does not know the secret key signature to hash the header and payload part, the integrity of the token will be maintained. This way, JWT has the advantage to maintain data integrity securely.

## **5.8 Payment Systems**

The payment system is an essential feature for Click & Eat as the customers are allowed to place an order which will need to be paid for. This section describes few popular payment systems researched in order to decide on the best one to be implemented for this application.

With the rapid development of science, computer, and network technology, electronic commerce (e-commerce) has become a common part of human life because it is convenient for customers, especially in business to consumer (B2C) commerce. In e-commerce, online payment systems have a very significant purpose and are used to perform e-commerce transactions (Bloomenthal, 2020).

Online payment is a type of electronic payment offered for real-time payment by a third party payment interface between banks. Online payment systems are more convenient, fast, practical and cost-effective compared to conventional payment systems. Users

may use their computers or mobile devices to complete the whole payment process in a short time (Craig, 2018).

### **5.8.1 Types of Payment Gateways**

A retailer uses a payment gateway to accept electronic payments and to be able to process credit or debit cards. Choosing the correct payment gateway dictates the currencies accepted, the fee for purchases, how easily money gets into the retailer's account, and the types of payment supplied.

In e-commerce, a payment gateway is the service that authorizes and processes payments. To promote the transaction flow between the customers and the online retailers, the gateway acts as a portal. To securely transfer the sensitive transaction data, it uses security protocols and encryption. The data is transferred from web or mobile applications to the payment processors, which are the banks and then back (Fernando, 2020).

#### **5.8.1.1 Stripe**

Stripe is a tailored-payment solution for eCommerce that supports all major payment types, including Apple Pay, WeChat Pay, Alipay, and Android Pay mobile payment providers.

This service provides detailed documentation, international assistance, and a monitoring system. Stripe supports 135 currencies and allows integration with other third-party platforms (Motola, 2020).

#### **5.8.1.2 Amazon Payments**

Amazon Payments, launched in 2007, is a giant payment platform built for online retailers, and the service is integrated into an API. It is available across devices concentrating mostly on mobile phone use. All major payment methods and credit cards are supported by the Amazon Payments service (Staff, 2019).

#### **5.8.1.3 PayPal**

One of the most commonly used electronic payment methods in the world is PayPal. For organizations of various sizes, PayPal provides flexible solutions. Via its gateway and numerous other strategies, PayPal provides processing of all the big credit and

debit cards and PayPal payments themselves. It also holds several services, including PayPal Payments Pro, PayPal Express Checkout, and Braintree (Hsiao, 2020).

#### **5.8.1.4 Braintree Sandbox**

Braintree (Braintree, 2021) is a PayPal service that provides a testing environment identical to the production environment useful for testing the payment of the application before going live. The Sandbox account created allows running transactions using test credit card numbers and exploring the functionality of the Braintree gateway.

To integrate Braintree in the application, the Braintree.net SDK will be installed for the server-side and the Braintree JavaScript V3 API for the client-side. The client-side API offers a secure custom Iframe for collecting sensitive data from the payment fields. Hosted Field solution is hosted by Braintree and gives the facility to customize the appearance of the form while ensuring that it is compliant with Payment Card Industry requirements.

#### **5.8.1.5 Payment Security**

Click & Eat is an application that contains a payment service so it is essential to provide the highest level of payment security to assure the customers that their data is safe.

Braintree Payment Gateway (Braintree, 2020) is used for the payment feature implemented in Click & Eat application.

Braintree offers a secure 3DS 2.0 payment option to all the customers. 3DS 2.0 represents the new industry standard for customer authentication. Braintree also uses data encryption to store payment information in the Braintree Vault.

The Braintree Vault stores cardholder data using different encryption keys with divided knowledge and dual control. Without the key, a data thief would be unable to make use of information stolen from a database. This datastore is not accessible over the internet.

Braintree is a validated Payment Card Industry Data Security Standard compliant service provider.

The checkout form uses Hosted Fields (Johnson, 2020) solution from Braintree, which secures all the sensitive payment fields on the form. It also gives the ability to customize the UI of the form while ensuring the PCI requirements.

## **5.9 Hosting Services**

Application hosting (Tsymbalyuk, 2021) is a hosting solution that allows users to access an application hosted on a platform from anywhere. It is usually offered by the hosting providers on a subscription basis.

The application will be hosted on a server placed in huge data centres owned by the hosting service providers. The way it works is that these servers accept requests from the application from the users' browsers and react back by sending the data requested to the browser. The users just need to type the application's address into their browsers to access it.

Before choosing web hosting services from a rich variety offered on the market, several options were researched.

### **5.9.1 Amazon Web Services**

Amazon Web Services (Labs, 2021) grants a wide range of cloud-based hosting solutions. AWS is very popular and reliable as it offers hosting for giant companies such as Netflix, LinkedIn, Twitch. AWS is preferred for hosting single-page applications built with ReactJS, VueJS, AngularJS, which require only a single load in a web browser. All subsequent actions by the users are made through the Html, JavaScript and CSS, which are pre-loaded in the browser.

Amazon S3 service is the most indicated AWS option to host this type of application because it delivers a highly performant and scalable setting at a fraction cost of a traditional web server.

AWS servers available worldwide are kept up by the Amazon backup system. The cost of acquiring a hosting service from AWS differs depending on the application's usage (aws, 2021).

### **5.9.2 Google Cloud**

Google Cloud (also known as Google Cloud Platform or GCP) (Fulton, 2021) is a software platform for designing, installing, and running web applications.

Despite its lack of capital as a result of its late entrance into the industry, it makes up for it in sheer features.

There are currently 18 availability zones on Google Cloud Platform, with three more on the way. It also has fewer services and capabilities than AWS and Azure, on the other hand, has shown signs of progress.

Google has the most affordable long-term rates. And, based on its offerings, it has a lot of space for expansion in the coming years (Labs, 2021).

### **5.9.3 Microsoft Azure**

Microsoft Azure (Apps, 2020) is a cloud storage service from Microsoft that allows developers to design, test, deploy, and manage applications and services via Microsoft-managed data centres.

Azure App service is an HTTP based service for hosting web applications and mobile apps. This service helps publishing web applications written in a variety of programming languages and running on a variety of frameworks. Besides the basic, standard and premiums plans, Azure offers a free plan for a year for students for applications which have lower traffic requirements (Pietschmann, 2016).

## 6. Chosen Technologies

The chosen technologies are discussed below and as the project progresses, it will be re-evaluated or modified to provide accurate results. After taking a number of technologies into consideration, it has been decided that Click & Eat should be a single page, responsive web application.

A single page application runs inside a web browser and the page actions do not require an entire page reload. The browser does not submit a request to load a whole new page when the user clicks a link, but instead uses JavaScript to control the current page and make it look like the user has navigated away.

Responsive web design is a technique that renders web pages well on a range of devices and window or screen sizes. Responsive interfaces alter and adjust to the size of the device's screen, whether it's a desktop, laptop, or smartphone.

To develop the application it is intended to use the following technologies:

- ASP.NET Core and C# for the server side code.
- ReactJS, JavaScript will be used for the client-side code.
- Bootstrap framework for layout and styling.
- MySQL to store and manipulate the data
- Braintree payment gateway
- JWT authentication and authorization
- Azure Web Apps for publishing the application

This application will be developed using the agile approach which focuses on producing the working code fast and gives the flexibility to adjust the scope and features of the project.



## 7. Conclusions

It is evident from the paper reviewed that technology has played, plays and will continue to play a crucial strategic role in the growth and progression of the hospitality industry. The whole industry has evolved from its sluggish beginnings with the use of technology to forge ahead in many areas of its industry.

Technological progress initially developed to support the efficiency of operation and reduction in labour, food, and other operational costs have ultimately assisted these companies in the achievement of the ultimate goal, customer satisfaction and repeat business.

Studies and surveys presented in this document have shown the industry effort to improve customer service and quality with the use of technology.

The Click & Eat system lines up with other existing similar products to enhance the ordering and payment process in the restaurant industry, providing better usability for both the customers and restaurateurs. The implementation of this proposed system will give the customers the power to order and pay directly from the table, saving them time by not having to wait too long for a waiter.

As this system is going to be a web application, Click & Eat will offer touchless ordering and payment solutions delivered to the customer's own device without the need to download an app and with the optional choice to create an account.

As well as transforming the customer experience, Click & Eat application will streamline the restaurant's operations, improve order accuracy and boost up revenue by encouraging repeat visits and powering loyalty.

This application will give restaurants the possibility to sell more by increasing table-turn and by connecting with customers, which will allow gathering valuable information that will be utilized in adapting the menu according to their needs.

Click & Eat will reduce the labour for the waiters and give them more time to spend offering excellent hospitality service, which means increased tips.

This proposed project also has a significant benefit in these times of pandemic because the human interaction will be reduced, and the customers will be more confident to dine out, lowering the possibility of contracting the virus.

Customers are becoming more technologically focused as they are now using technology to conduct business, purchase and sell items, make restaurant reservations and order meals from their remote locations. This study provided evidence that the restaurant industry can incorporate this proposed system which has the potential to improve the experiential quality of dining experience for customers.

This research points out that convenient technology can bring many benefits to the restaurant industry such as shortening the time spent in the ordering process, enhancing processing in food production, speeding up the service time providing faster ordering and payment, shortening seat turnover or turnaround time and decreasing labor cost.

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