PROJECT WHITEPAPER

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The Problem

Currently many businesses lack the technological resources to allow quick sales. This causes problems in efficiency, and therefore profitability and growth.

What is ExpressQ?

ExpressQ is a system that aids in the efficient operations of businesses. It allows for users to pre-order food online and collect items purchased in store with the use of a QR code. The easier management of orders and the overall reduction in user waiting time will increase customer satisfaction, and therefore profitability.

The system increases efficiency as it reduces the time customers spend waiting in queues, and removes the waiting time involved in cash or card transactions. The reduction in queuing time is highly beneficial to stores; quicker processing of orders reduces the amount of pressure placed on employees, and increases the likelihood that customers will return.

Additionally, the system allows for businesses to analyze their customer data. The analysis of data will provide businesses the ability to easily view information such as:

- Customer retention

- Average customer spending

- Popularity of items

- Items commonly purchased together

- Peak hours of business operations

Another feature of ExpressQ is the ability to leave ratings and reviews on products. This will allow users to have a better understanding of what they are purchasing and allow them to easily pick a business and items from a menu. Also, there will be a recommendation given to the user on the basis of other user purchases. For example: If a large set of $users_1$ purchase X and another large set of $users_2$ purchase X and Y then set $users_1$ will be recommended Y.

The constraints for a user using a system are the following:

- A user must have an android mobile device to run the ExpressQ application

- A user must have an account or create an account to access goods from venues.

- A user can only purchase goods from venues that are online.

- A user can only have one email account registered to ExpressQ,

- A user must pay for goods with the use of a credit/debit card.

- A user cannot pay with cash as the system is designed to eliminate cash transactions.

Product Impact

ExpressQ has the ability to revolutionize how small food and drink businesses operate. The faster processing of payments with the use of a QR code will save customers a lot of time by eliminating queues. It will also give businesses the ability to easily monitor how their stock is performing and whether or not there can be any improvements.

Competition

Some larger companies – Starbucks, for example – have developed similar products to ExpressQ in-house. ExpressQ allows small and medium-sized businesses lacking the resources to produce and maintain their own system to compete with larger businesses.

Another company that has similar features to our product is Just-Eat. ExpressQ has the competitive advantage in terms of features and cost. Just-Eat charges businesses an upfront cost of £500 and takes a cut of 8-12% of sales.

Commercialisation

ExpressQ will use a percentage and a membership based business model to derive revenue. The client will register with ExpressQ and will pay £40/monthly for the following services: access and updates to the system and general support. In addition, there will be a charge of 5% for each sale.

Companies that purchase ExpressQ will be issued with the required hardware and software. Also, staff will be trained on how to use the new system through assisted learning and documentation.

Marketing

Mainly small to medium businesses will be targeted. This will allow us to monitor the early stages of our software product with less complexity. We will initially offer a free demonstration of our software to interested companies. Allowing them to gain a better feel and understanding for our product and how it will benefit them. Also, training the staff on how to properly manage and operate the system.

To attract such companies, we will be primarily advertising our product in the business section of newspapers. Also, we will be campaigning our product through the use of social media platforms. The use of Facebook and Twitter's algorithms will allow us to target users looking for business improvements.

Financial

The total cost of developing ExpressQ is £57,060. We will be making predictions on our return of investment to identify the feasibility.

Assumption (1): On average a company sells £25,000 items using our system each year.
*Assumption (2): The growth of companies using our system after year 1 is: (Companies * 2) + (Companies 2) to 2dp*

This is our predictions:

- Year 1: At least 20 companies using our system.
    - Membership fees: £7,200
    - 5% cut of items: £20,000
    - Total turnover: £27,200
    - Return of investment of: -0.52 (total loss of £29,860)

- Year 2: At least 50 companies using our system
    - Membership fees: £24,000
    - 5% cut of items: £62,500
    - Total turnover: £56,640 (taken into account Year 1)
    - Return of investment: -0.007 (total loss of £420)

- Year 3: At least 125 companies using our system
  - Membership fees: £60,000
  - 5% cut of items: £156,250
  - Total turnover: £215, 830 (taken into account Year 2)
  - Return of investment: 2.78 (total profit of £158,770)

The ExpressQ system

The customer-facing part of the ExpressQ system consists of a web application designed to be accessed from desktop web browsers and a mobile application that can be used on Android smartphones.

Customers will be able to browse the various menus and place an order using either application and can pick up their order using the Android application by presenting a unique Quick Response code (commonly known as a QR code) upon collection. The business scans this QR code using their Android application to confirm the identity and order of the customer. Once this is done the worker can then give the customer their order, this process will decrease the amount of time both the customer and the worker spend on the transaction by cutting out the need to wait in-store for the order to be ready and the in-store payment process.

Businesses can use the web application to create the menus customers can order from by adding and removing products. They can also change information related to the business such as their opening hours and whether they are currently open for business. Businesses will use the Android application to scan the QR codes when a customer picks up their order.

The ExpressQ system will provide users with the following functionalities:

1. The ability to create a customer or business account.
2. Customers should be able to place an order.
3. Business account holders should receive orders as they are placed by customers.
4. Customers should be able to collect an order.
5. Customers should be able to browse through participating stores.
6. Business account holders should be able to withdraw received money from their account.
7. Customers should be able to save their billing information.
8. Customers should be able to save their order preferences.
9. Business account holders should be able to declare themselves open or closed to new orders.
10. Business account holders should be able to see the details on all orders placed with them using the system.

The system also has the following non-functional requirements:

- The web application should be accessible by the following major desktop web browsers: Chrome 54.0, Firefox 40.0, Safari 10.0, and Edge 25.10586.
- The Android application should support Android 4.4.1 and above.
- The system as a whole should have an annual uptime of 99%.
- The system should provide data protection. Achieved through required logins.
- A confirmation email should be sent to the customer once an order has been placed.
- The system should respond to a confirmed order within 5 seconds.

QR Codes

A core part of the ExpressQ system is the use of QR codes in order collection. A QR code is similar to the barcodes used in shops however they can store more information due to their increased complexity. Where a barcode can only hold information in a horizontal direction a QR code stores information both vertically and horizontally. This allows the average QR code to store 100 times more data than a 1-dimensional barcode.[1]

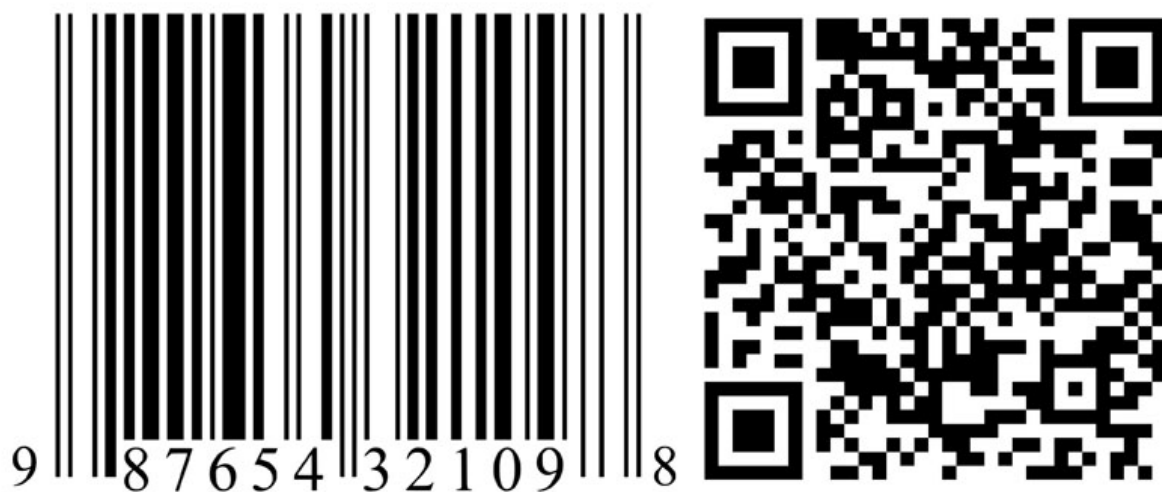[1] https://foxdesignsstudio.com/uploads/pdf/Three_QR_Code.pdf

Figure 1 side-by-side comparison of a barcode and QR code

To read a QR code the camera of the Android phone is used and the phone interprets what it sees and translates this into data that it can use, commonly numerical or alphanumeric data. The QR codes in the ExpressQ system will store a numerical code unique to every order. Using a numerical code allows the storage of 7,089 characters at maximum, this allows our system to handle up to $7,089^{10}$ unique codes as each individual character can be any number 0-9.[2]

All QR codes follow a similar structure to that in the above figure. which can be scaled up as needed. The QR code is a square surrounded by a white border, the 'quiet zone'. In the corners on the left side and the top right corner are solid-black squares surrounded by a solid-white and a solid-black border, this is the 'finder pattern.' In the above image in the bottom-right, there is a smaller solid-black square surrounded by a solid-white and solid-black border, this is an 'alignment pattern.' The rest of the QR code consists of black and white cells in which the data is encoded. In a larger QR code there may be more than one alignment pattern within the data.[3] The functions of these are as follows:

- 'Quiet Zone' – Makes it easier for the phones camera to detect the QR code by reducing the amount of unnecessary data, such as the surroundings of the QR code, captured by the camera.
- 'Finder Pattern' – Allows the phone to detect the position of the QR code. Through the alignment of these three squares the phone can detect the size, angle, and position of the QR code.

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[2] ibid.

[3] ibid.

- 'Alignment Pattern' – Allows the QR reader to correct for distortion in the QR code. This distortion occurs most commonly when the QR code is bent or curved.

Data Analysis

An important feature of the ExpressQ system for our business users is the ability to analyse their customer data. This analysis allows businesses to gain valuable insights into information such as their customer retention, the popularity of various items and their peak hours. Businesses can use this information to improve the operation of their business, resulting in increased profits and higher customer retention. Initially we plan on offering five different analysis metrics:

- Customer Retention Rate
- Average Customer Spending
- Item Popularity
- Items Commonly Purchased Together
- Peak Business Hours.

Customer Retention Rate

The customer retention rate shows what percentage of customers returned to a business over a given timeframe. This is calculated by comparing the number of customers the business has at the end of this timeframe (EC), subtracting any new customers (NC). This is divided by the number of customers at the start of the timeframe (SC). The result is multiplied by 100 to get the rate as a percentage.

Customer Retention Rate = ((EC-NC)/SC)*100

Average Customer Spending

It can be important for a business to know how much their customers spend on average over a given timeframe. This is calculated using the total customer spend over a given timeframe (TCS) divided by the number of customers over that timeframe (NC).

Average Customer Spending = TCS/NC

It may be the case that the average customer spending changes after a change to the business, for example after the introduction of a new product or a change in prices. Thus, we shall provide the ability to view the average customer spending as a time series chart. As an example, if a business introduced a new product midway through a month the average daily customer spending could be calculated using the above formula and a chart plotted using this information to easily see if the new product caused a change in the average customer spending.
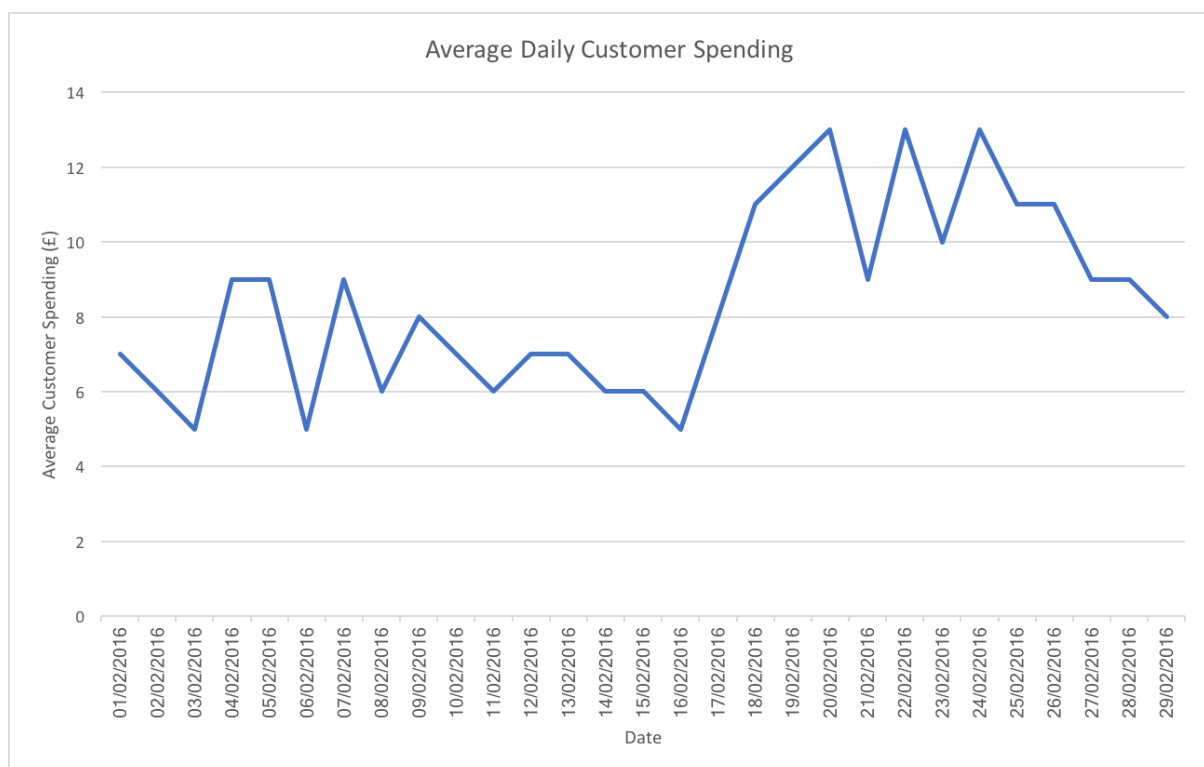

Figure 2 An example of an average customer spending chart.

Item Popularity

Item popularity can be used by business to see which of their products should be stocked more heavily than others and which products it might be better to discontinue as their lack of sales does not make up for the cost of production.

The business user selects the period they wish this to be calculated over. The system goes through all the orders made over that period and keeps a running total of how many items were sold for each individual item. These totals are then added together to get the total number of items sold (TIS), and divided by the number of different items the business sells (NI). The resulting number is the average number of items sold. To calculate how popular a given

item compared to the average popularity the number of individual items sold (IIS) is divided by the average number of items sold. The result of this calculation is how many times as popular an item is compared to the average.

Item Popularity = (IIS/(TIS/NI))

As an example, a business sold 230 sausage rolls in a week and 600 products in total over that week while offering 12 products.

$$\text{Item Popularity} = (230/(600/12)) = 4.6$$

The result of the above calculation shows that a sausage roll is 4.6 times as popular as the average product.

Items Commonly Purchased Together

Businesses may wish to know which items are commonly purchased together to know which items should be located near each other in the store, this will allow the data collected on customers using the ExpressQ system to be used to influence customers who have not yet adopted the system. This metric will provide the most commonly purchased item pairing for every item the store sells.

Peak Hours

It is important for a business to know when their peak hours are. This knowledge enables them to have the appropriate amount of staff and stock at their busiest times, ensuring the smooth operation of their business. ExpressQ will allow businesses to view their average peak hours for a range of periods including the past month, the past year, and since the business became a user of the system.

The Future

As it stands there are a few steps that would need to be taken before the application could go from prototype to business ready. Many of the details mentioned previously would take priority but there are also some other details that would need our attention. These are as follows:

- <u>Form a Company</u>: Before anything else, to turn the application from a prototype to a finished product, an official company would need to be formed. While we as a team can complete the application and any early documentation associated with it, there are various roles which we would be unable to fill. If we were to form an official business then new employees such as lawyers, accountants, advertisers etc. could easily be hired, whether this may be on a temporary basis or not.

- <u>Get Funding:</u> From here it is possible to then work on procuring funding for our project. There are two options, to obtain investors or take out a loan. Both options have advantages and disadvantages associated with them.

  A loan would obviously indebt us to whichever bank it was withdrawn from but we would still have full control of the whole company. However, if we were to take out a loan we would not be making as big of a profit as we would need to use our revenue to pay off monthly instalments.

As for having an investor of some kind, we would not be indebted to anyone but would unfortunately have to give up some control of the company to these investors.

- **Making the Application Available**: Presently we are the only ones that can access the application, because we have the files and the means to run them. We would need to upload the application so that the public could easily access it. To make the android application available to all android users we will need to upload our application to the Google Play store. This would ensure that android users could download and use the application as intended. Without doing this we could have businesses who purchase the system but have no way for their customers to collect their order.

  The android application is not the only way for users to access the application though. It should also be available through a web browser too. This would mean a domain would have to be purchased and would in turn provide a URL for the user to locate the web page for the application.

- **Advertising:** As stated earlier in the marketing section of our paper our target market will be small to medium businesses. To get word out about the system it will be advertised through advertisements in newspapers and through social media. However, in the case of Facebook the amount of people you can reach depends on how much you pay Facebook for advertisement space. Despite this, they do monitor what users are searching for, on and off of Facebook, so we would be safe in knowing that our application was being advertised to people looking for business improvements.

  Any interested companies could then be given a free demonstration of the software and how it works.

  Once companies purchased and started using the software this would in turn advertise the application to customers. This would also further advertise the software to other companies, spreading word around and allowing the system to grow.

- **Future Development** Once the system is complete and fully business ready the only thing left is potential development for the future and general maintenance. It is important that our software stays up to date and keeps up with the latest trends. We need to do this to ensure that we continue to be ahead of our competitors as it is important to hold the monopoly over our market. Some potential ideas are:

- o Extending the system for use in concerts and/or clubs. These are venues that also tend to have very long queue times which could be sped up with our product.
- o Allowing the system to be used outside of food and drink businesses. At its core, the system is just for pre-ordering goods. Typically, outside of food and drink businesses there aren't long waiting times for completing transactions but the system could still improve a company's efficiency. It would still be much quicker to order goods, quickly pick up the product and leave than going through the whole payment process while in store.
- o Incorporate a rewards system. One purpose of the application is to encourage customers to return to their stores again. A system that rewarded loyal customers could further encourage repeat business.